COMMUNICATIONS

INCLUDING "RADIO ENGINEERING" AND "TELEVISION ENGINEERING"

MAY

★ TELEVISION ENGINEERING DESIGN AND APPLICATION

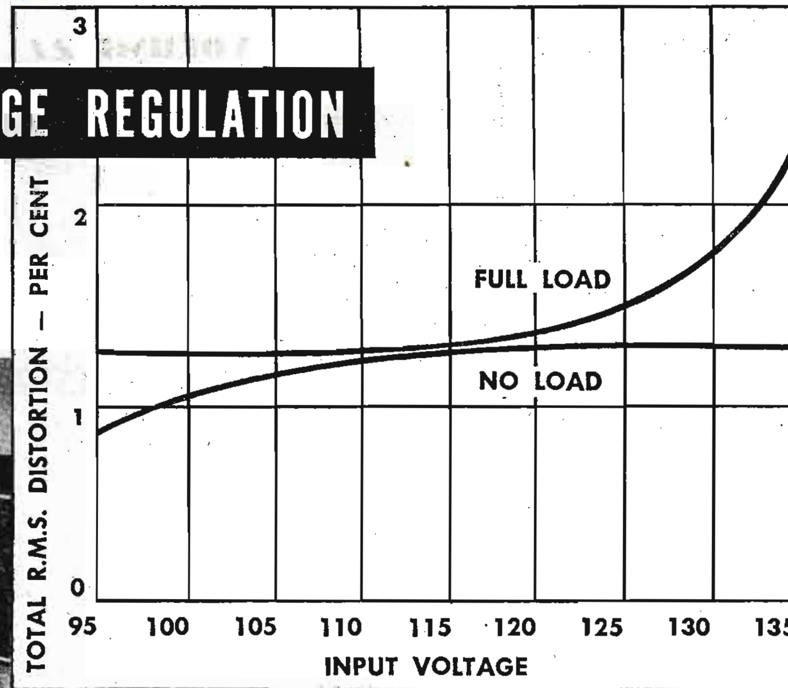
★ R-F AND AUDIO FACILITIES IN F-M AND A-M BROADCASTING

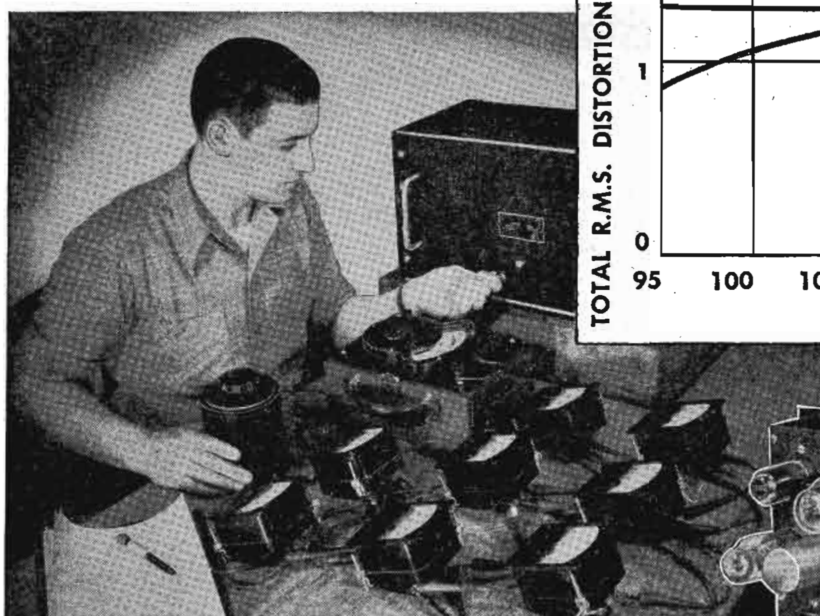
1947

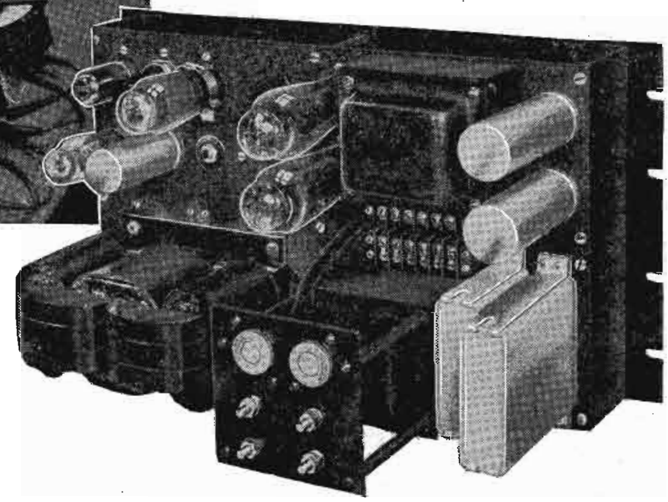
5-31-47

INSTANTANEOUS VOLTAGE REGULATION

WITH 2½% MAXIMUM WAVEFORM DISTORTION







STABILINE

Instantaneous Electronic

Voltage Regulator

At no load . . . full load (1KVA) . . . or any intermediate load, the new STABILINE Type IE Voltage Regulator maintains a constant output voltage to within ± .1 volt of nominal with negligible waveform distortion. Examine the graph. Although the line voltage may fluctuate from 95 to 135 volts, the waveform distortion never exceeds 2½ per cent.

If your problem is maintaining a constant output voltage from a fluctuating line, you will want to investigate this new Superior STABILINE Voltage Regulator. Write for more graphic information illustrating performance at various frequencies, power factor loads, input voltages and other operating conditions.

Write Superior Electric 945 Laurel Street For Information and Literature

THE SUPERIOR ELECTRIC CO.

BRISTOL, CONNECTICUT

POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLY • STABILINE VOLTAGE REGULATORS

MAY, 1947 VOLUME 27 NUMBER 5

COMMUNICATIONS

Including Television Engineering, Radio Engineering, Communication & Broadcast Engineering, The Broadcast Engineer. Registered U. S. Patent Office.

LEWIS WINNER
Editor

F. WALEN
Assistant Editor

Bryan S. Davis, President
Paul S. Weil, Vice Pres.-Gen. Mgr.
F. Walen, Secretary
A. Goebel, Circulation Manager

Chicago Representative:
Lawrence Wehrheim
5510 W. Lemoyne Ave., Chicago 51, Ill.
Telephone MERrimac 7919

Cleveland Representative:
James C. Munn
2656 E. 126th St., Cleveland 20, Ohio
Telephone CEdar 7783

Pacific Coast Representative:
Brand & Brand
1052 W. Sixth St., Los Angeles 14, Calif.
Telephone Michigan 1732
1085 Monadnock Bldg., San Francisco 5, Calif.
Telephone Douglas 4475

Wellington, New Zealand: Te Aro Book Depot.
Melbourne, Australia: McGill's Agency.

Entered as second-class matter Oct. 1, 1937 at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: $2.00 per year in the United States of America and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.

COVER ILLUSTRATION

Television monitor console in operation with a 5-kw tv transmitter. (*Courtesy RCA*)

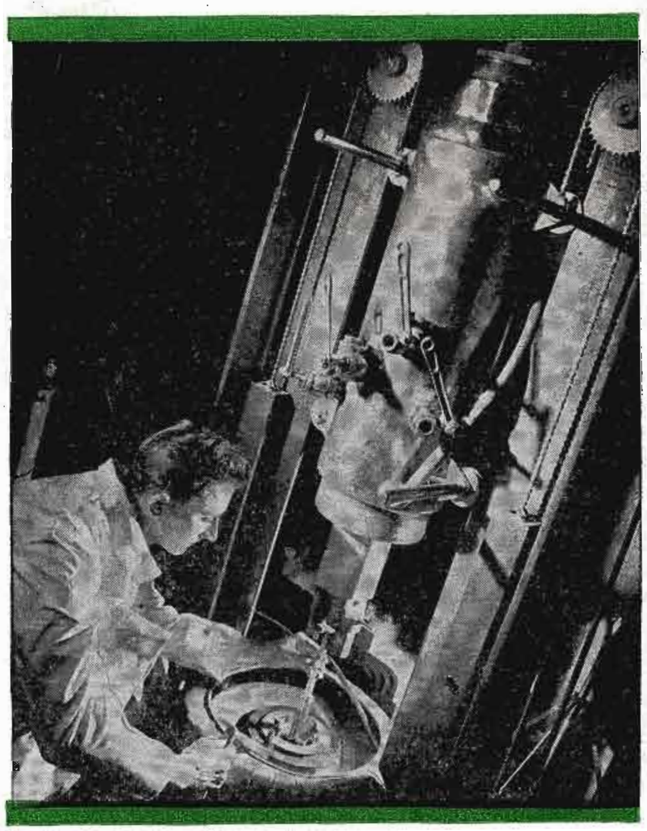
Published monthly by Bryan Davis Publishing Co., Inc.
52 Vanderbilt Avenue, New York 17, N. Y. Telephone MUrray Hill 4-0170

SYLVANIA RESEARCH NEWS

MAY *Prepared by* **SYLVANIA ELECTRIC PRODUCTS INC., Bayside, L. I.** **1947**

INTRICATE LABORATORY TECHNIQUES GUARD QUALITY OF TUNGSTEN IN SYLVANIA TUBES

Basic Studies of Wire Conducted at Each Stage of Production to Insure Electronic Tube Perfection

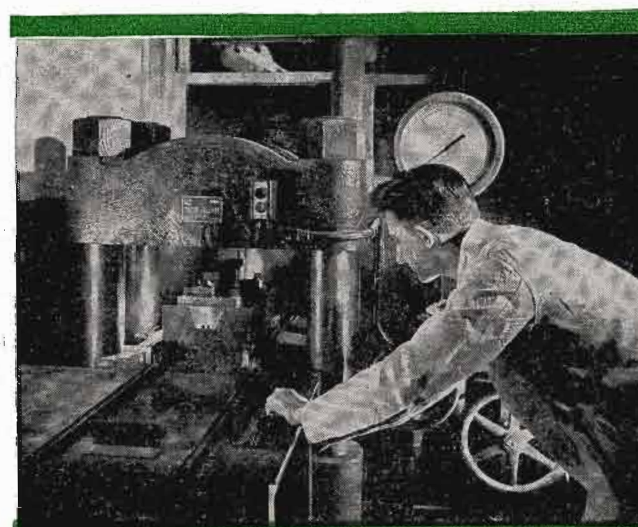


Tungsten for radio tubes (and incandescent lamps) is prepared by heating the powdered tungsten bars to incandescence in sintering bottle. Researcher is placing tungsten bar between electrodes which will pass 150 kw through slug and heat it to 6800° F. Hydrogen atmosphere prevents oxidation. During sintering operation the porous tungsten powdered bar is transformed into a homogeneous metallic slug which can be swaged and drawn down to wire of a diameter as low as .0004″.

Two of the many metallurgical tests constantly carried on by Sylvania Electric are illustrated here.

To insure electronic tube perfection — to have Sylvania radio tubes measure up to long-established Sylvania standards — every important type of research technique is utilized.

Here electron microscopes, giving magnifications of thousands of times, are employed. Hardness testers, sag testers, gas analysis equipment, tensile testers are but a few of the methods used to guard the high quality of tungsten utilized.



Prior to sintering operation shown at left, tungsten bars of approximately ½″ square are prepared by pressing finely divided metal powder under hydraulic pressures of up to 300 tons. The equipment used to pursue such studies is illustrated in the above photograph.

Both of the photographs shown here are indicative of the fundamental studies that have resulted in the development and maintenance of tungsten wire of superior quality.

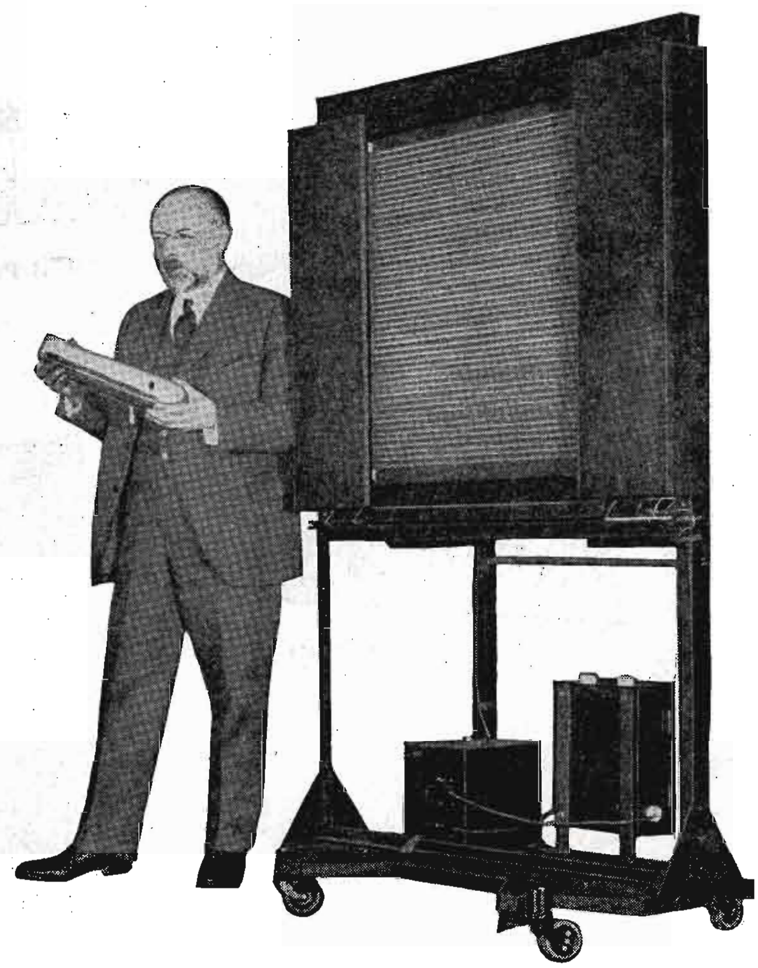
Radio Tube Division, Emporium, Pa.

SYLVANIA ELECTRIC

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS

5-31-47

Long-distance Television is twenty years old



At the 1927 demonstration, Dr. Herbert E. Ives explained the television system developed in Bell Telephone Laboratories.

April 7 is a notable day in communication history, for on that day in 1927 was the first demonstration of television over long distances. Large-scale images were flashed from Washington, D.C., by wire and from Whippany, N.J., by radio to a public demonstration in New York City. "It was," said a newspaper, "as if a photograph had suddenly come to life and begun to smile, talk, nod its head and look this way and that."

That was the first of many public demonstrations, each to mark an advance in the television art. In 1929 came color television, and in 1930 a two-way system between the headquarters buildings of A. T. & T. and Bell Laboratories. When the first coaxial cable was installed in 1937, television signals for 240-line pictures were transmitted between Philadelphia and New York and three years later 441-line signals were transmitted. By May, 1941, successful experiments had been made on an 800-mile circuit.

End of the war brought a heightened tempo of development. Early in 1946 began the regular experimental use of coaxial cable for television between New York and Washington, and a few months later a microwave system for television transmission was demonstrated in California.

Transmission facilities will keep pace as a great art advances to wide public usefulness.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

TO EACH CUSTOMER FOR HIS SPECIFIC NEEDS

Unusual resistance to abrasion? High dielectric strength? Insurance of uninterrupted service in telephone communications? Each reel of Ansonia Ankoseal holds wire or cable earmarked for applications where it will do the best possible job. Our engineers can solve your cable problems.

THE ANSONIA ELECTRICAL DIVISION
ANSONIA, CONNECTICUT *of*
NOMA ELECTRIC CORPORATION

with the New Collins 20T 1 kw AM transmitter

Let the brilliant overtones of high fidelity flow through circuits engineered *for* high fidelity. The 20T development, a new postwar success, reveals in each detail the quality of its design.

Dual oscillators. Two temperature-controlled oscillators, adjusted to your operating frequency, are self-contained in the 20T. A selector switch enables you to place the spare unit in operation when you remove the other for maintenance.

Two cabinets. Past practice has been to crowd a kilowatt transmitter into a single cabinet. The Collins 20T gives you two cabinets with lots of room, genuine accessibility, ample ventilation, and impressive appearance.

Program protection *and* circuit protection. In addition to magnetic circuit breakers and two-shot d-c overload relays, the 20T has high voltage capacitor fusing. Should a capacitor fail, the fuse opens the circuit and a spring bar shorts the capacitor terminals. The transmitter stays on the air and the faulty capacitor is indicated.

Filament voltage regulator. For longer tube life, and low noise and distortion levels, the 20T tube filaments have a constant voltage supply.

Attractive styling. The cabinets are attractively styled in three-tone gray. Their modern, distinctive appearance, simplicity of design, and pleasing color harmony will give many years of eye appeal and satisfaction.

Eye level metering—centralized controls—motor driven tuning elements—forced air cooling—high safety factors—30-10,000 cps audio response ± 1.0 db—3% audio distortion—minus 65 db noise level.

Only the Collins 20T gives you all these desirable and important features. Deliveries will begin early this year. We suggest you write for detailed specifications, study them, compare them, and then place your order for early delivery. Let us supply your entire equipment needs. You'll have an integrated system that will keep the sparkle in your programs and put a sparkle in your station.

FOR BROADCAST QUALITY, IT'S . . . COLLINS

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 W. 42nd St., New York 18, N. Y. 458 S. Spring St., Los Angeles 13, Calif.

A BUYERS' GUIDE... for

War Surplus electronic tubes, devices and equipment declared surplus by the armed forces are available for purchase through "Approved Distributors". The War Assets Administration put this plan in operation to expedite the disposal of needed materials.

If you are a manufacturer, jobber or dealer, contact one of the approved distributors listed here. They will know what and how much of this property is available for immediate delivery. This is your opportunity to obtain needed equipment at a considerably reduced cost.

fast action

WAA APPROVED DISTRIBUTORS OF GOVERNMENT-OWNED SURPLUS ELECTRONIC EQUIPMENT

(wholesale only)

American Condenser Co.
4410 No. Ravenswood Avenue
Chicago 40, Illinois

Automatic Radio Mfg. Co., Inc.
122 Brookline Avenue
Boston 15, Massachusetts

Belmont Radio Corporation
3633 So. Racine Avenue
Chicago 9, Illinois

Carr Industries Inc.
40-22 Lawrence Street
Flushing, L. I., N. Y.

Communication Measurements Laboratory
120 Greenwich Street
New York 6, New York

Cole Instrument Co.
1320 So. Grand Avenue
Los Angeles 15, California

Tobe Deutschmann Corporation
863 Washington Street
Canton, Massachusetts

Electronic Corporation of America
353 West 48th Street
New York 19, N. Y.

Electro-Voice, Inc.
Carroll & Cecil Streets
Buchanan, Michigan

Emerson Radio & Phonograph Corporation
76 Ninth Avenue
New York 11, N. Y.

Essex Wire Corporation
1601 Wall Street
Ft. Wayne 6, Indiana

General Electric Company
Building 267, 1 River Rood
Schenectady 5, New York

General Electronics Inc.
1819 Broadway
New York 23, N. Y.

Hammarlund Mfg. Company, Inc.
460 West 34th Street
New York 1, New York

Hoffman Radio Corporation
3761 South Hill Street
Los Angeles 7, California

Hytron Radio & Electronics Corporation
76 Lafayette Street
Salem, Massachusetts

Johanns & Keegan Inc.
62 Pearl Street
New York 4, N. Y.

E. F. Johnson Company
206 Second Avenue, S. W.
Waseca, Minnesota

Majestic Radio & Television Corporation
125 West Ohio Street
Chicago 10, Illinois

National Union Radio Corporation
57 State Street
Newark 2, New Jersey

Navigation Instrument Co., Inc.
P. O. Box 7001, Heights Station
Houston, Texas

Newark Electric Co., Inc.
242 West 55th Street
New York 19, New York

Radio Parts Distributing Company
128 W. Olney Road
Norfolk 10, Virginia

Smith-Meeker Engineering Company
125 Barclay Street
New York 7, N. Y.

Southern Electronic Company
611 Boronne Street
New Orleans, Louisiana

Standard Arcturus Corporation
99 Sussex Avenue
Newark 4, New Jersey

Sylvania Electric Products, Inc.
Emporium, Pennsylvania

Technical Apparatus Company
165 Washington Street
Boston 8, Massachusetts

Tung-Sol Lamp Works, Inc.
95 Eighth Avenue
Newark 4, New Jersey

W & H Aviation Corporation
Municipal Airport
Rochester 3, New York

ELECTRONICS DIVISION

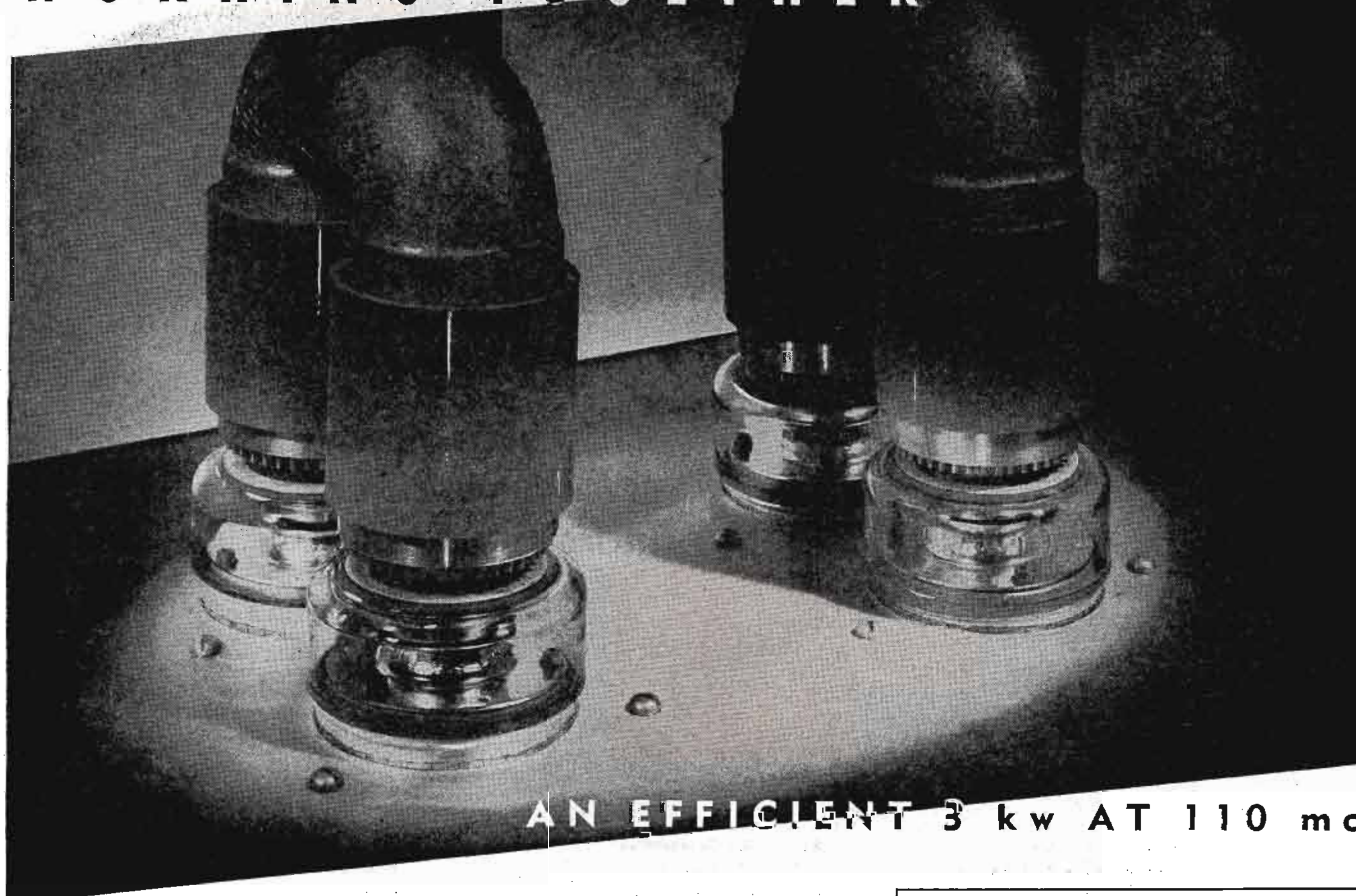
WAR ASSETS ADMINISTRATION

GOVERNMENT SURPLUS W A A

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland
Denver • Detroit • Grand Prairie, Tex. • Helena • Houston • Jacksonville • Kansas City, Mo.
Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia
Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa

1062

WORKING TOGETHER



AN EFFICIENT 3 kw AT 110 mc

Four Eimac 4X500A tetrodes provide a standout answer to the question of getting 3 kw of useful output power in the new f-m band and above. In a push-pull parallel arrangement these remarkable tubes generate this power with only 50 watts of drive. Operating data on the tubes in this actual installation are listed in the accompanying table.

Some of the design features of the Eimac 4X500A can be seen in the adjoining illustration. Short squatty geometry contributes to high-frequency capabilities by bringing the grid and plate lines close up to the elements themselves. The screen is brought out to the concentric contact ring surrounding the base. This makes it easy to seat the tubes into a ground-plane deck for effectual isolation of input and output circuits with consequent operating stability.

Low driving requirements of the 4X500A have obvious advantages for designers of original equipment. They also present operators of low-power f-m stations with an easy and efficient means of converting to 3-kw operation by letting their existing final amplifiers loaf as drivers for a set of Eimac 4X500A tetrodes in parallel push-pull.

Write for full details on Eimac 4X500A tetrodes and 3-kw f-m operation.

EITEL-McCULLOUGH, Inc., 1445 San Mateo Avenue
San Bruno, California

Follow the Leaders to

Eimac REG. U. S. PAT. OFF. **TUBES**

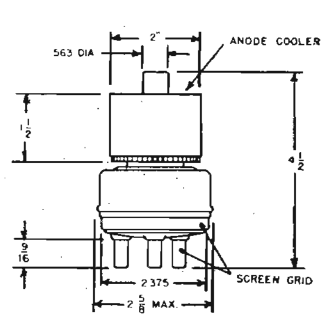
The Power of FM

EIMAC 4X500A TETRODE
Electrical Characteristics

Filament: Thoriated tungsten	
Voltage	5.0 volts
Current	13.5 amp
Screen-grid amplification factor (av.)	6.2
Direct Interelectrode Capacitances (av.)	
Grid-plate	0.05 μμf
Input	12.8 μμf
Output	5.6 μμf
Transconductance (i_b:200 ma.; e_b:2500 v; E_{c2}:500 v)	5200 umhos

Typical Operation
(Four tubes push-pull parallel, 110 mc)

Plate voltage, d-c	4000	volts
Plate current, d-c	1.25	amp
Screen voltage, d-c	500	volts
Screen current, d-c	160	ma.
Grid voltage, d-c	-250	volts
Grid current, d-c	70	ma.
Driving power (approx)	50	watts
Plate power output (approx)	3900	watts
Useful power output	3500	watts



4X500A

EXPORT AGENTS: FRAZAR & HANSEN, 301 CLAY ST., SAN FRANCISCO 11, CALIFORNIA, U.S.A.

COMMUNICATIONS

LEWIS WINNER, Editor

MAY, 1947

V-H-F COMMUNICATIONS WINNING WIDE ACCEPTANCE:

The unusually effective application possibilities of v-h-f communications has prompted one of the liveliest development programs in communications history. Installations which a few years ago were thought of by many as "pipe" dreams, are now becoming actualities.

In Venezuela, for instance, there'll soon be installed, over a 135-mile oil-pipe-line system, a 30- to 40-mc f-m communications link. The radio link, which will afford ultra-reliable information for dispatching of oil shipments, will provide for five telephone and three teletype channels and will work into either local or long-distance telephone lines. Only one repeater will be used to cover this unusually long distance.

Engineers, making the Venezuelan installation, are arranging for other long-distance oil-line f-m communications systems in South America and Europe.

Power companies, old-time users of radio links, are also expanding their uses of v-h-f systems. In West Virginia, a power company is installing two 40.98-mc stations to transmit hydrological and meterological data.

Drilling and oil production operations are also receiving the benefits of v-h-f. In Longview, Texas, a 31.98-mc system operating with 10 mobile units, will soon be used to expedite drilling and oil production.

From the University of Miami has come a v-h-f application that's really a "fiction book" item. A 27.44-mc 1-watt transmitter will be used to transmit tennis instruction to players who will wear a miniature receiver attached to the small of their back. Hearing-aid type earphones will be used.

V-h-f comunications is certainly spreading its wings on many fronts.

SAFETY VERSUS EMERGENCY:

The proposed use of the term *safety*. instead of *emergency*, to describe police and fire radio systems, appears to have won the nod of many in Washington. It is the general concensus that both police and radio are actually responsible for the *safety* of the community and are on *continuous* watch. Placed under public safety radio rules and receiving the broader provisions of such regulations, police and fire communications service would be materially improved and the public would profit accordingly.

RMA STANDARDS PROGRAM:

Striking progress on transmitting-equipment standards was reported by the various RMA engineering committees at the recent Syracuse spring meeting.

Presented were a complete set of performance standards for a-m transmitters. Offered, too, were proposed standards for studio facilities, f-m broadcast transmitters, aural and video transmitters, tv relay systems, marine aids, aeronautical radio, microwave transmission and audio facilities. A proposed set of standards on facsimile, which would permit the establishment of a public facsimile broadcast service, was also offered at the meeting.

The standards are unusually complete. In the f-m proposal, for instance, are sections on antennas and towers and solid dielectric r-f transmission line, and studio-transmitter link systems.

The standards' committee members have done an outstanding job, providing an all-important design and production procedure which will be invaluable to the broadcast industry.

SPOT TUNING AND F-M:

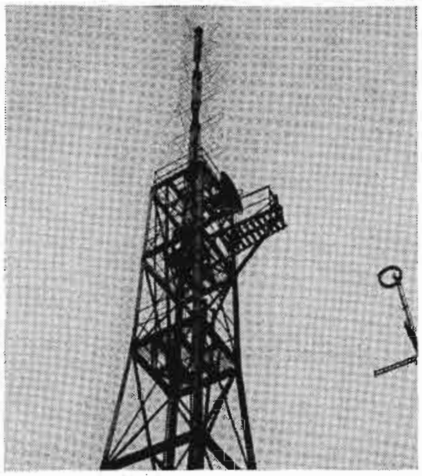
The increased use of f-m by commercial services and broadcasters has prompted accelerated research on tuning control. Multiple harmonics, caused in part, by proximity of broadcasting stations and their channels, has already caused the FCC to propose a shift in allocations and broadening of the channels. The separation may not be the answer in all communities, particularly where there are many active commercial systems such as taxis, bus, police, fire and trucks on the air, and where the receiver has an extended tuning range of 44 to 216 mc. Tuning may be difficult and spot tuning has been suggested. One company has already introduced an automatic-frequency-control method within a 6J6 r-f oscillator system. Push buttons are provided for spot tuning. Some manufacturers are working on the application of crystals, which are particularly useful in close-station tuning control. The use of lock-in circuits using either capacitor or permeability control, following wartime practice, is a feature of some of the proposed systems.

Commercial message privacy has also entered the tuning study and government specialists are quite concerned. The FCC has already released a rider to the FCC engineering-standard rules alerting manufacturers to the problem that may become more acute in the months to come.

WE'VE BEEN MICROFILMED:

The complete contents of the 1944 to 1946 issues of COMMUNICATIONS have been microfilmed. We understand that several libraries have already received copies of the microfilm. We plan to install a microfilm reader soon, too, for the convenience of any who might wish to review articles which appeared in 1944, 1945 and 1946.—L. W.

The WABD SUPER-TURNSTILE TV



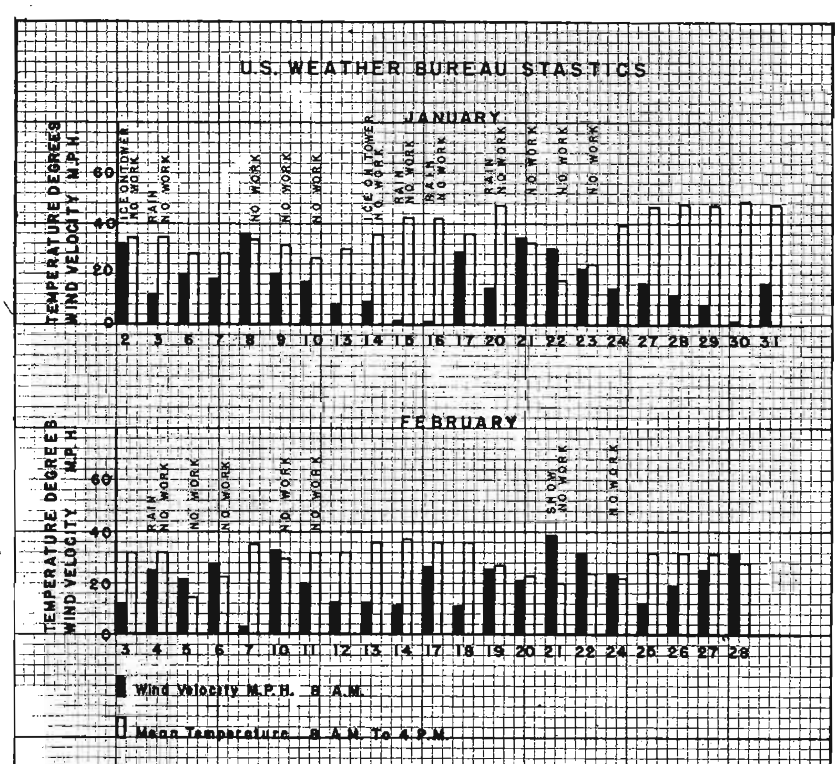
A
The batwing tv antenna atop Madison Avenue skyscraper in New York City.

IN PLANNING FOR AN ANTENNA installation the site is, of course, quite a factor. In arranging for the new WABD antenna, the site interest was correspondingly quite keen. It was felt that a choice location existed in the Madison Avenue, New York City, location, where all tv activities were centered and where the previous antenna was mounted. The belief proved correct, for excellent results have been recorded. But the installation on the existing 80-foot tower, 500 feet above sea level, involved quite a series of problems, problems that will undoubtedly be met in other tall office-building installations.

We found, for instance, that the demand for facilities in large office buildings made it impossible to obtain any additional floor space for storing, checking, and inspecting the new equipment prior to installation. Congested city traffic at the entrance of the building and the limited size of the receiving platform presented difficulties in handling heavy shipments. In addition, no large freight elevators were available. Highly unionized labor conditions had to be coped with; not only as they affected the particular project, but also all other projects already in progress in the building.

Elaborate plans were made to expedite the installation of the new antenna in October, 1946. Unforeseen events, however, prevented the actual starting of construction until the middle of December, 1946. Adverse weather conditions, Figure 1, prevailed during the installation, and emphasized the importance of each operation. This presented an excellent opportunity to evaluate the importance of the steps taken in planning and expediting the project.

Figure 1
Chart of weather conditions that prevailed during installation of tv antenna.



Before detailed plans were formulated, the building manager was consulted to determine the policies and regulations with regard to the use of the building facilities. This step proved to be the most efficient move that could have been made in preliminary planning, as the number of conditions imposed were amazing.

Despite the fact that competent architects had advised us that a New York City *building permit* was not necessary, it was of prime importance to the building manager. Other factors affecting the plans, which were subject to his approval, were:

(*1*) Choice of contractors; union contractors were specified and compensation and insurance papers of the contractors had to be presented to him.

(*2*) Hours and methods for moving equipment to the roof.

(*3*) Receiving-material space; no extra space was available.

(*4*) The requirement for maintenance engineers and technicians when the pole was transported to the roof; plus the required elevator operators.

And all work was to be approved by the manager.

Plan Filing

From previous contacts with the New York City Building Department we knew that it would be wise to file our plans far in advance of actual construction. The primary purpose of this permit is to obtain authorization for the steel work. Therefore the architect took information from the assembly specification drawings of the antenna, prepared the necessary legal documents, and filed them with the City Building Department. Although the process appears obvious, it should be noted that this step was consummated before detailed plans were completed. This action was taken because of the time-consuming nature of these details, and because the wheels of local governments are slow in overcoming stationary inertia.

Although the super-turnstile[1] (known as the *batwing*) antenna is practically a packaged article and does not present any complex problems, certain tolerances must be met. As a

Antenna Installation

Batwing-Type Antenna Mounting Atop 80-Foot Tower of New York City Skyscraper, 500 Feet Above Street Level, Required Series of Detailed Plans to Provide for Variations in Weather, Office-Building Installation Rules, Labor Requirements and Technical Requisites of the Antenna System.

by ARTHUR W. DENEKE

Project Engineer
Allen B. DuMont Laboratories, Inc.

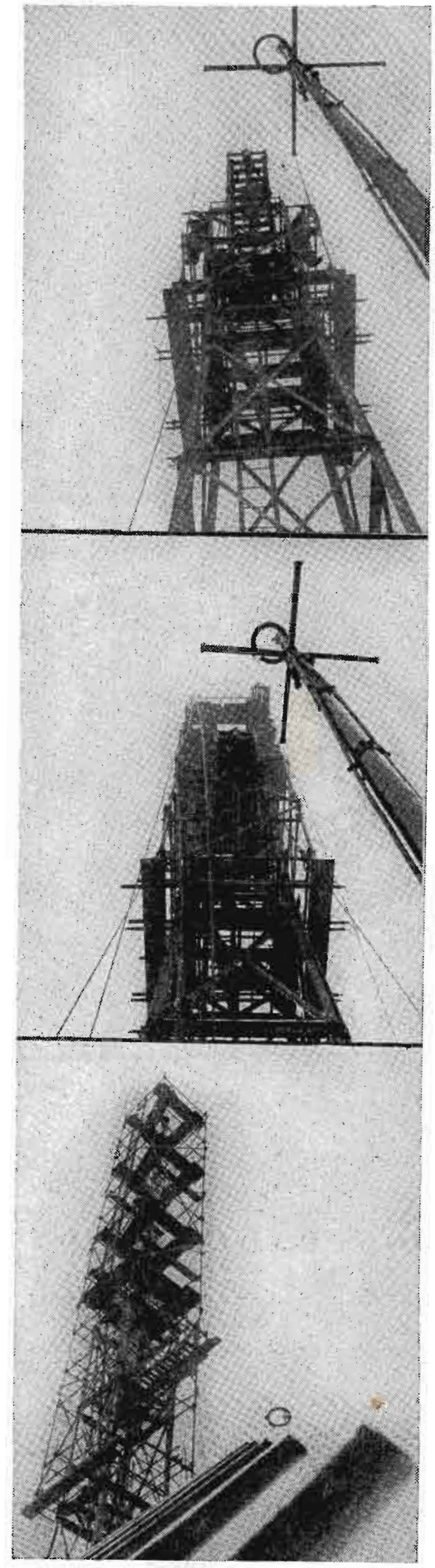
unit, the antenna is adaptable to any installation. Final results, however, are dependent on initial steps in the installation. For instance, once the position of a certain radiator is fixed, the method of running 1⅝" lines to the roof is limited. Therefore, it was necessary to prepare detailed drawings to show the complete layout of the assembly from the top of the tower to the diplexer and transmitters. In addition to the assembly drawings of the antenna, we had to obtain the size and weights of the crates containing the component parts and tabulate them; Figure 2. This chart was used to determine which parts could be moved through the building during the regular working hours. All material not in this category, because of size or weight, was held for shipment at a specified time. Arrangements were made to have a special truck arrive with this equipment, when steel workers would be on hand, to take it directly to the roof of the building.

In awarding the contracts for the project, due consideration was given to the problems which might develop from union jurisdictional disputes. Therefore, it was deemed advisable to forego the usual method of awarding contracts and select contractors who had worked together on previous projects and had mutual agreements as to the division of work. This method proved particularly advantageous and

[1]RCA.

		Dimensions			Weights	
No.	**Description**	**Length**	**Width**	**Height**	**Net**	**Gross**
1.	Six ¾" r-f feed lines	63"	61"	13"	83	300
2.	Two junction boxes and r-f feed-line accessories	39"	29"	10"	78	164
3.	Pole clamps of radiators and junction boxes	41"	16"	14"	150	200
4.	Four radiating elements	108"	10"	48"	100	150
5.	Four radiating elements	108"	10"	48"	100	150
6.	Four radiating elements	108"	10"	48"	100	150
7.	Twelve deicing elements	84"	4"	4"	25	35
8.	Six lengths, 1⅝" transmission line	246"	8"	6"	260	300
9.	Six lengths, 1⅝" transmission line	246"	8"	6"	260	300
10.	Four lengths, 3⅛" transmission line	124"	10"	10"	92	125
11.	Diplexer	90"	32½"	25½"	500	708
12.	Diplexer accessories	77"	6"	6"	6	27
13.	Pole section	216"	8⅝" diam.		780	...
14.	Pole section	198"	7" diam. (average)		530	...
15.	Pole section	180"	5" diam. (average)		258	...
16.	Pole section	102"	7⅝" diam.		297	...

Figure 2
Tabulation of size and weights of component parts to determine method of handling and required storage space.



Figures 3, 4 and 5
Figure 3: Details of scaffolding foundation. Six 2" pipes supported the first 20' of the structure. Figure 4: Weight of scaffolding transferred from foundation to top of tower by the use of cables from corner anchorage to top of tower. Figure 5: Completed scaffolding structure. A minimum of footing was provided to reduce wind resistance.

Figures 7, 8, 9 and 10
Figure 7: Main section of pole suspended from upper right hand corner of scaffolding at point *A*. Figure 8: Pole section clearing clears the last obstruction. Men were stationed at points *C* and *D* for emergency call. Figure 9: How the pole section was eased inside the scaffolding and lowered into place. Figure 10: Final section of pole guided into place.

achieved the desired harmony. Steel workers were to transport the spur pole and miscellaneous equipment to the roof in addition to erecting the scaffolding, spur pole, and *batwings*. The rest of the work was classified as electrical work.

The preliminary work of preparing the tower for the new antenna consisted mainly of removing the previously used retractable pole. Every effort was made to salvage this equipment. A study of the problems involved proved conclusively that the most economical solution was to cut the pole into lengths suitable for manhandling them through the building.

The first step in the actual work of construction was the erection of the scaffolding. The specifications for this work held the amount of obstruction inside the tower proper to a minimum and specified 43′ of scaffolding providing an 8′ x 8′ clearance above the top of the tower which was only 5′ 5″ square. The project proved routine once the details of the foundation, 20′ below the top of the tower, had been worked out by the supervisor in charge of erecting the scaffolding.

The scaffolding arrangements are shown in Figures 3 and 4. In Figure 3 it can be seen that only six 2″ pipes were inside the tower proper to support the planks for the corner anchors. As the scaffolding progressed and the weight became heavier, cables were strung from the four top corners of the tower proper to the four corner anchors of the scaffolding; Figure 4. Thus the load was actually supported by these cables.

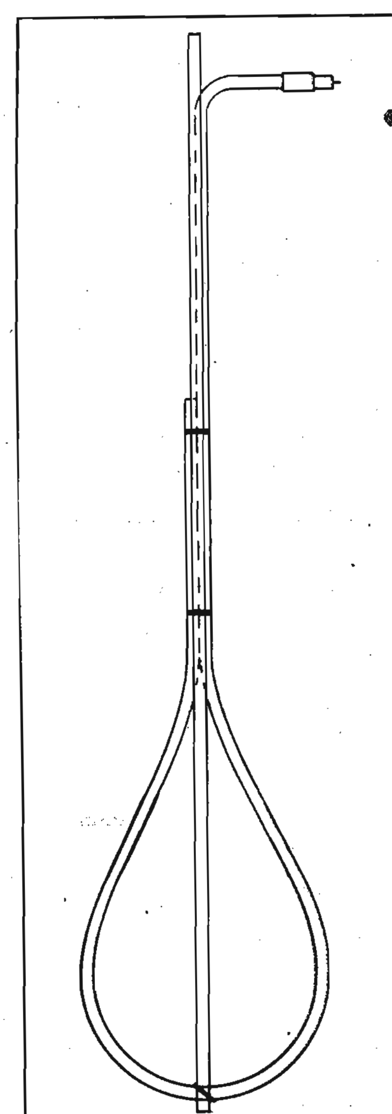
Figure 5 shows the completed scaffolding structure. The platforms were located at specified intervals calculated to provide convenient working

Figure 6
Analysis of time required to complete the project.

Contractor	Man hours
Rigging	
Removal of old pole	47
Moving new equipment to roof	20
Moving new equipment to roof	30*
Preparing tower for new pole	30
Erecting pole and radiating elements	66
Cutting hole in roof	6
Painting antenna	4
Scaffolding	
Moving material to roof	35*
Erection of scaffolding	168
Removal of scaffolding	112
Removing material from the roof	28*
Building Management	
Elevator Service	59*
Electrical Work	
Removal of old transmission lines	41
Moving new transmission lines to roof	6*
All electrical work on antenna	314
Total	*966*

*Time requiring compensation for overtime.

Figure 11
Configuration of r-f feed line reinforced by length of hard-drawn copper tubing.



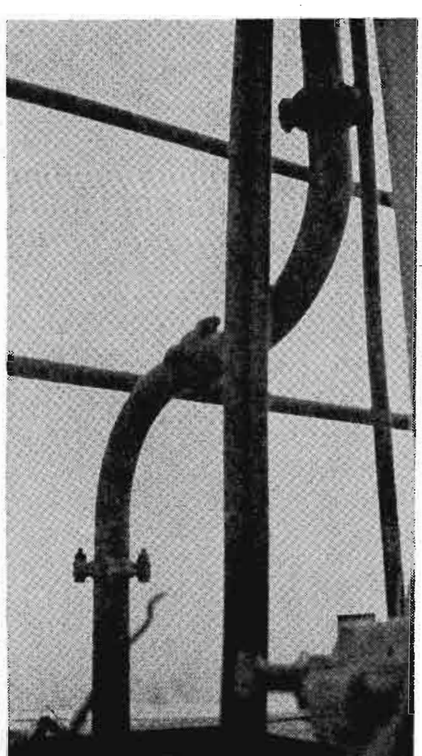
conditions for both electrical and steel workers.

The erection of the scaffolding accounted for 16 days instead of the 3½ days actually worked; this delay was caused by bad weather; Figure 1.

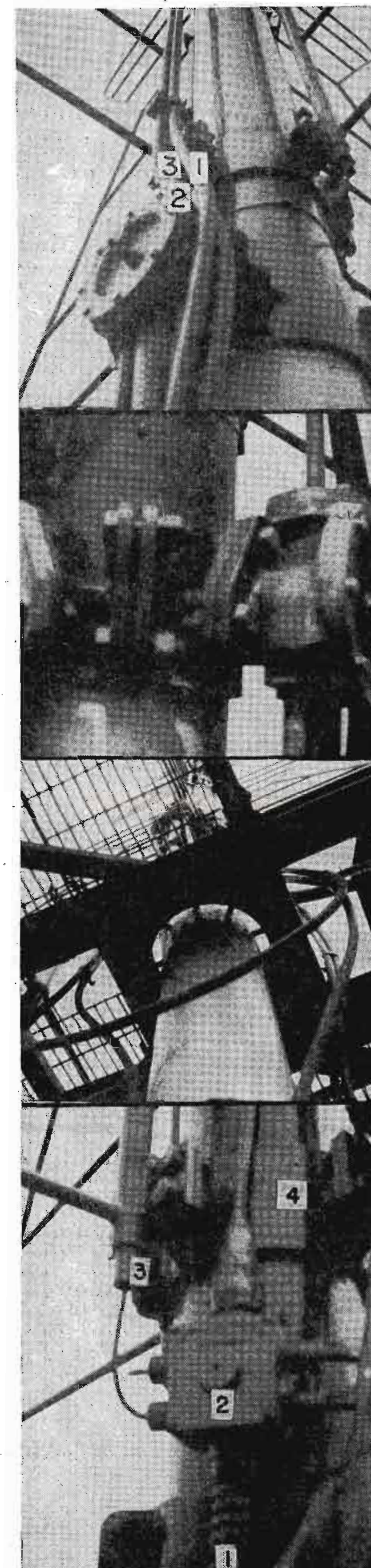
The antenna pole was shipped in four sections, as requested, after determining that 20′ was to be the maximum length of pole as required by building facilities. The most difficult section to handle was 18′ long by 8⅝″ in diameter, and weighing approximately 780 pounds.

Considerable difficulty was experienced in getting this section of pipe to the roof. A special platform was constructed on top of the regular service elevator, which was then lowered to the floor below. A system of pulleys was hung from an *I* beam located between the elevator shafts to hoist the top of the section up into the elevator shaft. The butt end rested on a dolly until it entered the elevator shaft and could be eased onto the platform. The top was then brought over and lashed to the elevator cables. The problem of unloading at the top of the shaft was simplified by a system of trap doors in the ceiling just outside the elevator. These doors had evidently been provided for moving electrical apparatus into place above the elevator shaft, as facilities for rigging anchorage were provided in the penthouse roof which was 30′ higher than the main roof

Figure 12
Combination of two 90° elbows used to start the vertical line to roof.



Figures 13, 14, 15 and 16
Figure 13: Details of feed-line system on "N" radiators. Line *3* from top bay determined the position of the junction box. Figure 14: Details of pole clamp for junction boxes. Figure 15: View through underside of top platform of tower showing final arrangement of ¾″ feed lines and 1⅝″ transmission lines. Figure 16: 1, a-c power line for de-icing equipment; 2, junction box for heating element connections; 3, heating element; 4, pole clamp for radiator supports.



where the section was to be placed. Therefore, intelligent rigging and clever handling of the section by the four steel workers was all that was required to complete the task.

Work on this part of the project could not be started before 9 P.M., at which time most of the tenants would have left the building. This was one of the conditions imposed by the building manager; material had to be moved through the main entrance of the building as the freight elevators did not run to the top floor. A detailed account of the time required to move the four sections of pole to the roof is shown in Figure 6. This chart also shows the number of man-hours required to complete each part of the project.

The men in charge of the erection of the pole and *batwings* had previously erected an f-m *batwing* antenna, and were familiar with the fundamental requirements. This asset enabled them to take full advantage of the break in the severe weather conditions, indicating that experienced personnel is highly desirable.

The skill of these men was responsible for making a spectacular job look simple, and demonstrated the value of delaying the start of the project until the services of experienced tower men could be secured.

The method of raising the sections of pole is illustrated in Figures 7, 8, and 9. A simple pulley was secured to the top corner of the scaffolding at point *A* in the upper right-hand corner of Figure 7. One end of the steel cable was attached through the pulley to a manually operated winch securely fastened at the bottom and inside of the tower. The other end of the cable was kept outside of the scaffolding and tower. This arrangement made it possible to keep the pole sections clear of the tower and was necessary because of the arrangement of platforms, ladders, and cross-bracings inside the tower. In addition to the two men operating the winch, one man controlled the tag line to guide the sections over obstructions, and two additional men were on the tower.

The end of the section clearing the last protruding obstruction is shown in Figure 8; the function of the tag line was about completed in this oper-

(*Continued on page 37*)

Placing a 3-Kw F-M Broadcast

Area Pre-tested With 50-Watt F-M Unit. Four-Bay Circular Antenna Used With Transmitter Which Provides 8.5-kw Radiated Power.

by **ROBERT G. SOULE, Jr.**

F-M Engineer
WFBL, Syracuse, N. Y.

EARLY IN 1941 it was decided to enter the f-m field of broadcasting. In March of that year property was purchased on a hill 1590′ high near Pompey, New York, about eleven miles airline southeast of Syracuse. However, due to the outbreak of war construction of the station was postponed. In January, 1946, it was decided to proceed with the f-m station construction and an order was placed for a 3-kw transmitter[1] and a 4-element circular antenna.[2]

Selection of Site

In preparing for the installation, it was necessary to review our 1941 site selection. We found that from a physical angle, the site lacked access by road. This could be corrected by moving ⅝ mile south, but we wondered if that location was suitable to cover the predicted 11,500 square miles included in our 50-microvolt contour. We believed that the answer could be found with a field test. Accordingly the engineering staff built a 50-watt c-w test transmitter operating in the new f-m band and installed a 70′ plywood mast with a horizontally-polarized dipole at the top. The antenna was so arranged that it could be manually rotated by means of hand lines. Using R G 11/U transmission line, our radiated power was 40 watts. Field measurements were then taken along 8 radials for a distance of 15 miles, and from this data it was learned that the new site was as good as any site within 20 miles of Syracuse.

The 50-Watt Test Transmitter

The test transmitter was designed to emit a c-w signal at 94.7 mc carrier, and station identification was made by keying the cathode of the final amplifier.

In choosing a multiple factor for our output frequency, we selected a multiple of twenty-four times the crystal frequency because of the abundance of 75-meter crystals available in this area.

Stability was gained by using voltage regulation on the oscillator and first two multiplier stages, and by using two separate power supplies.

Metering was applied in the grid circuits and in the cathode of the final amplifier. This permitted all metering jacks to be at ground potential. The plate tank capacitors of the first three multipliers were operated with their rotors also at ground potential permitting single hole mounting and eliminating any hand-capacity effect.

The plate tank circuit of the 2E26 and the grid circuit of the 829B were placed at unity coupling with the 829B grid coil self-resonant. The r-f drive to the final amplifier was adjusted by moving the 2E26 plate coil in and out until maximum final grid current with minimum reactance to the driver plate tank was reached.

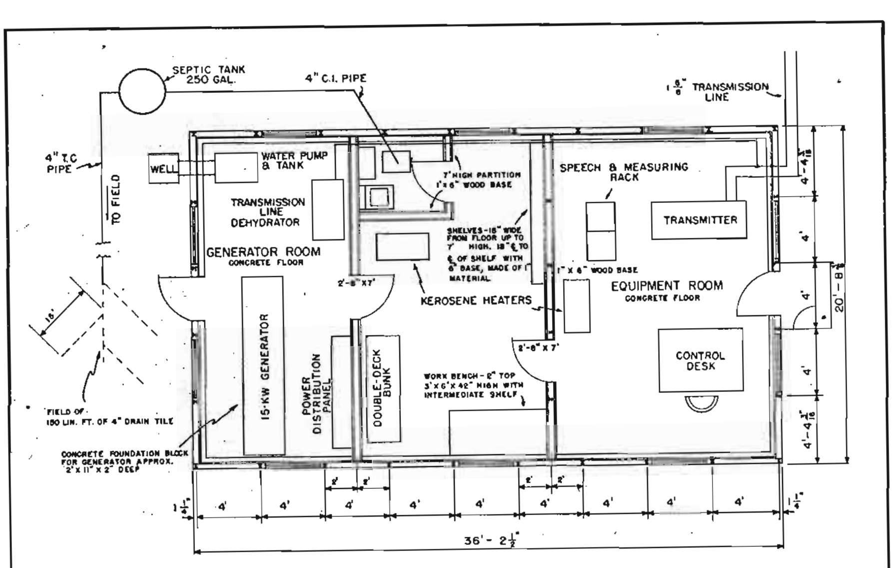
The antenna, incidentally, was constructed of two lengths of ⅜″ copper tubing, each length being 29″ long.

Transmitter Building

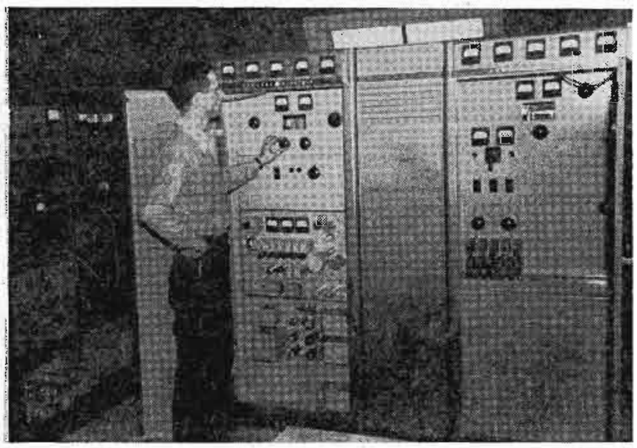
The type of a transmitter building to erect posed quite a problem. The Civilian Production Board refused our first application for a concrete block building, and, after several attempts to find suitable building material which would be approved, we decided on a 20 x 36 quonset hut. At first, we had our doubts about this type of building. However, we found that with proper insulation (our temperature ranges from above 90° to 40° below zero) the hut was very satisfactory. The unique design of the hut prompted several equipment installation innova-

[1] G.E. BT-3A.
[2] G.E. BY-4A.

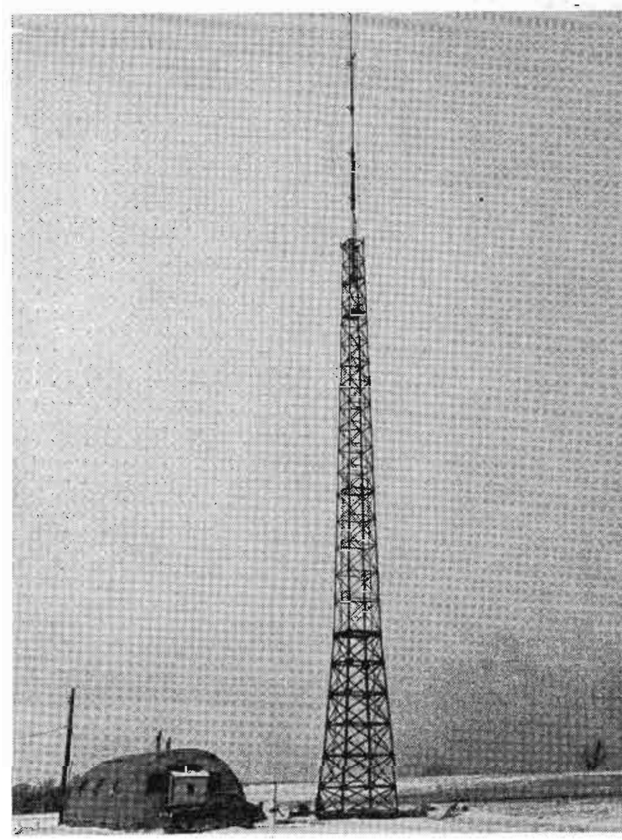
Floor plan of WFBL f-m transmitting-office-studio hut.



TRANSMITTER IN OPERATION



D. F. Langham, engineer-in-charge, at controls of 3-kw transmitter and speech racks.



(Right)
Transmitter building and antenna.

tions. The building was divided into three sections: generator room, storage and living room, and equipment room. The generator room houses a 25-kw 3-phase 230v a-c generator,[3] well pump, power and telephone distribution panels, and an automatic transmission line dehydrator.[4]

In the storage and living room were placed a lavatory, double-deck bunks, electric hot plate, equipment and spare tube cupboards, kerosene heater[5] and work bench.

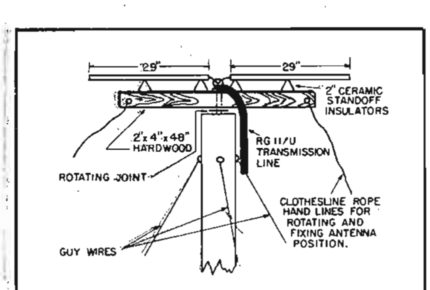
The equipment room contains the transmitter, speech and measuring equipment and transmitter control console, plus a second heater.

Building insulation consisted of 4″ rock wool, plus ½″ thick insulating board. Tempered masonite, ⅛″, was laid on all inside walls from the floor to a height of 8′ to protect the soft insulating board. Both wall partitions were fully insulated to keep the generator noise out of the equipment room as much as possible. To eliminate vibration to the rest of the building, the generator block was placed

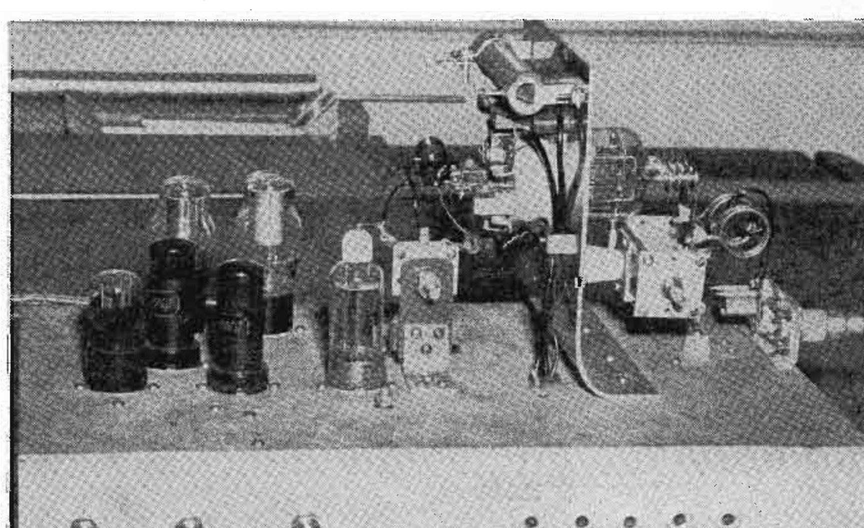
---

[3]Buda.
[4]Dielectric Products Company X-22.
[5]Coleman.

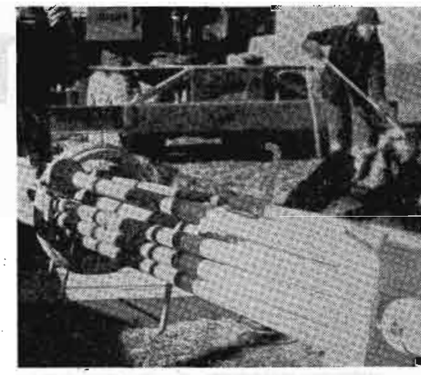
Layout of temporary antenna used with 50-watt test transmitter.



View of 50-watt test transmitter.



(Left)
Erecting the circular antenna.



(Lower right)
Section of circular antenna used by WFBL.

(Upper right)
Assembled antenna.

in a floating position with an expansion joint. The floating procedure was applied to the floor to prevent foundation vibration. In the flooring beneath the transmitter and speech racks 6″ wide channels were placed to facilitate wiring. The rest of the wiring, both a-c and telephone circuits, was lead shielded and run in conduits buried in the concrete floor.

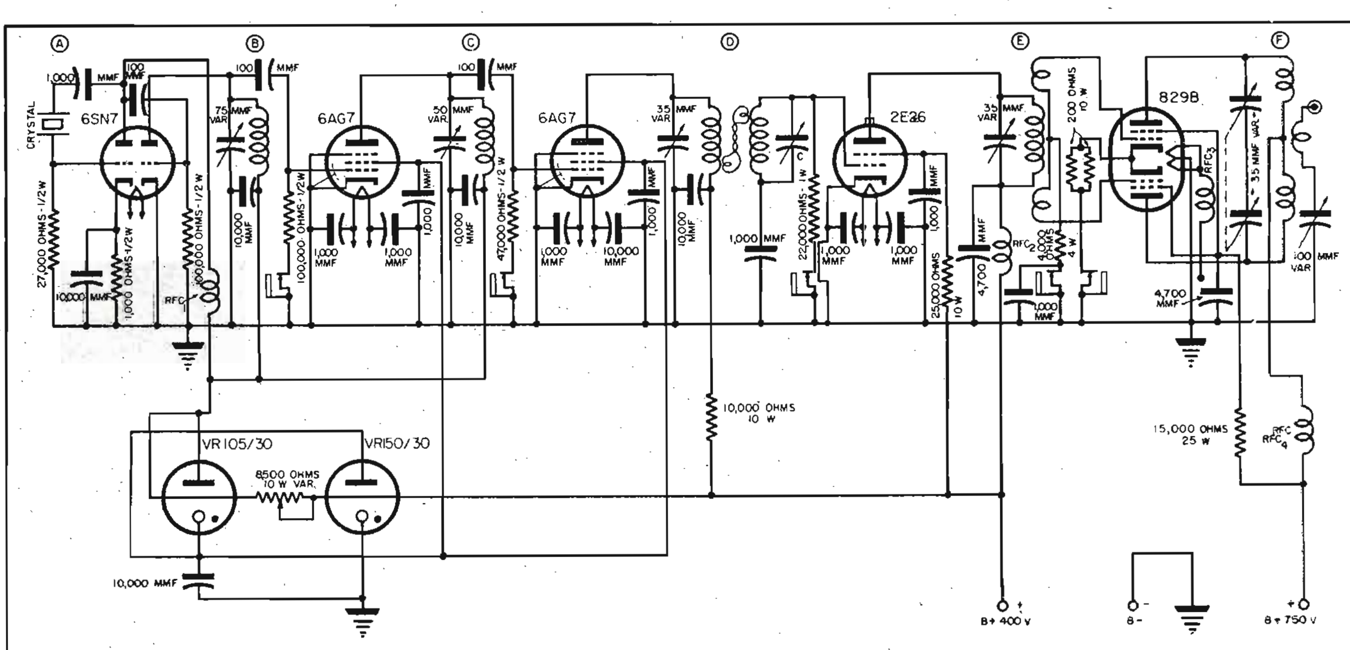
Power Source

Our original plan was to operate 3-phase 220 v a-c supplied by the local power company. Due to erection difficulties, they were able to supply us with only single phase 220v a-c. Therefore, our gasoline generator, which was intended to be an emergency standby unit, has become our primary source of power. It is possible, however, with a switching arrangement to operate everything except the transmitter itself from either the single-phase service or our own 3-phase service. In this way, the generator need not be operated except when we are actually on the air.

Antenna Erection

The antenna supporting tower is a self-supporting 105′ square-tapered tower mounted on a four-section 48-ton reinforced concrete base. This

(Continued on page 46)



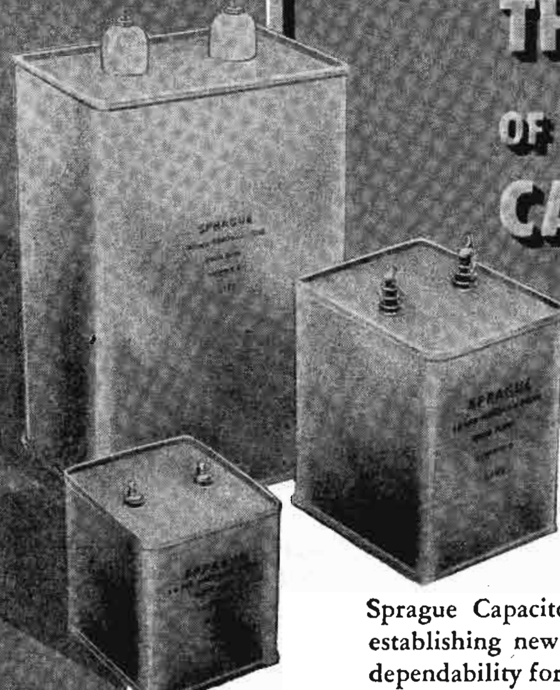
Circuit of 50-watt f-m test transmitter. Frequency at *A*, 3.946 mc; *B*, 11.838 mc; *C*, 23.676 mc; *D*, 43.352; *E* and *F*, 94.704 mc.

SPRAGUE

VITAMIN Q DIELECTRIC

(TRADEMARK REG. U. S. PAT. OFF.)

HAS PERMITTED SUBSTANTIAL RE-DUCTIONS IN BOTH THE SIZE AND WEIGHT OF MANY OIL-FILLED CAPACITOR TYPES



TYPICAL! Compact Capacitors for Photoflash and Energy Storage Uses

Sprague Capacitors with Vitamin Q dielectric have led in establishing new standards of compactness, light weight and dependability for electric flash tube (photoflash) photography. Also, they assure outstanding economies and greater efficiency for flash welding and time control circuits where duty cycles other than those used in photoflash work prevail. Write for Sprague Engineering Data Bulletin No. 3205.

SPRAGUE ELECTRIC COMPANY, North Adams, Mass.

PIONEERS OF ELECTRIC AND ELECTRONIC PROGRESS

Electronic ATTENUATORS

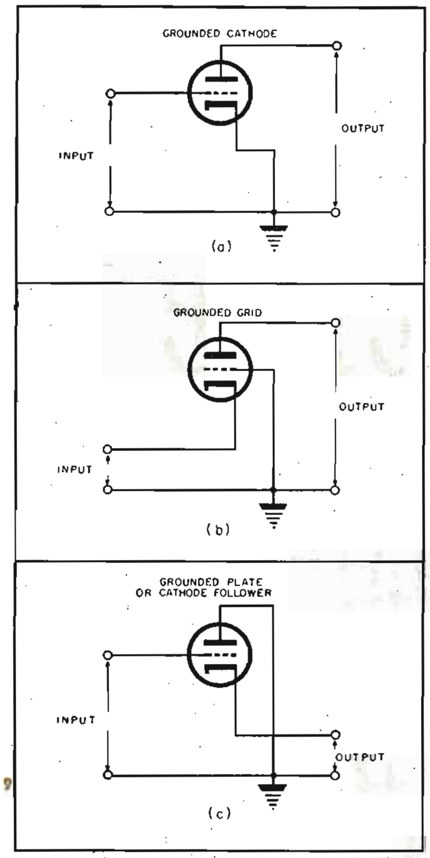


Figure 1
Vacuum-tube amplifier circuits.

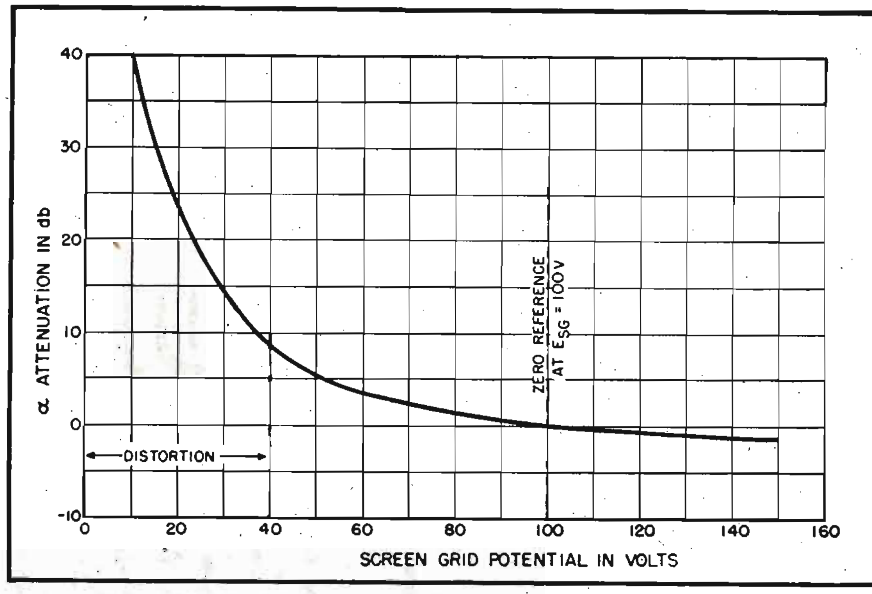


Figure 2
Attenuation characteristics of a 6SJ7 pentode. Plate voltage = 200; fixed grid bias = —5 v.

THE DESIGN OF AN ATTENUATOR network, comprised of passive linear elements, is dictated by the input and output impedances, and the transmission loss required. These factors are not independent of each other; this is illustrated by the fact that there is a definite minimum insertion loss associated with a given ratio of input to output impedance. For the common types of attenuator pads, even a relatively low impedance ratio, i. e. 2:1, results in a minimum loss of about 7.5 db.[1]

V-T Amplifier

The three design factors just mentioned may be effectively divorced from each other, however, by employing a vacuum-tube amplifier as an attenuator. Considering the amplifier stage as a four-terminal network, it is evident that there are three possible circuit configurations which may be used; Figure 1. In each of these, the stage gain can be reduced to less than unity, and it would therefore be possible to use any one of the three as an attenuating device.

However, a comparison of these with regard to the independence of the input impedances and the distortion produced by each with a stage gain of less than unity,[2] yields the conclusion that the grounded plate or so called cathode-follower circuit of Figure 1*c* is best adapted for application as an attenuator.

Cathode-Follower Voltage Gain

The voltage gain, A, of a cathode follower having a resistive load, R, is[3]

$$A = \frac{\mu R}{(\mu + 1)\,R + r_p} \qquad (1)$$

where r_p and μ are the plate resistance and the amplification factor of the vacuum tube, respectively. This expression ignores as negligible the effects of the interelectrode capacitances within the vacuum tube.

The amplification factor, μ, may also be written as

$$\mu = g_m\, r_p \qquad (2)$$

where g_m is the vacuum-tube transconductance. Inasmuch as the factor $g_m\, r_p$ is much greater than unity for pentodes and for most triodes as well, substitution of equation (2) for the factor μ in equation (1), yields the following expression, for A,

$$A = \frac{g_m R}{g_m R + 1} \qquad (3)$$

The attenuation, α, introduced by the cathode follower will thus be

$$\alpha = 20 \log_{10} \frac{g_m R + 1}{g_m R}\ \text{db} \qquad (4)$$

For high values of attenuation, the product $g_m R << 1$, and equation (4) may be further simplified to

$$\alpha = 20 \log_{10} \frac{1}{g_m R}\ \text{db} \qquad (5)$$

From equation (4), it is evident that the attenuation may be varied by

[1]D. Espy, *Attenuator Design Formulae*, Electronics; Nov., 1941.
[2]S. Moskowitz, *Cathode Followers and Low-Impedance Plate Loaded Amplifiers;* COMMUNICATIONS; March, 1945.
[3]*Reference Data for Radio Engineers*; Second Edition, p. 156, Federal Telephone and Radio Corporation; 1946.

altering the vacuum-tube transconductance or the cathode-load resistance. The transconductance may be conveniently varied by controlling the d-c electrode potentials of the amplifier tube, permitting both electrical and mechanical isolation of the attenuation control from the signal circuit. While variations in the control grid bias have the greatest effect on the transconductance, the use of this method of control will introduce severe waveform distortion and clipping. Plate voltage variation, or screen voltage variation in the case of pentodes, will provide distortionless attenuation over a limited range. In Figure 2 is shown the attenuation characteristic of a 6SJ7 pentode, which was obtained by screen-voltage variation. For the operating conditions specified, an attenuation of 8 db was obtained before slight waveform distortion occurred. Where appreciable waveform distortion can be tolerated, considerably larger attenuations are possible. Cascaded stages may also be employed to secure a greater attenuation range by means of electrode-potential control.

An Analysis of an Electronic Attenuator Based Upon the Cathode Follower or Grounded-Plate Amplifier Circuit. Circuit Provides Theoretically Infinite Attenuation Without Distortion Over a Wide Range of Frequencies at Any Input or Output Impedance Level. Continuously Variable Attenuation Is Secured by Varying the Cathode Load and the D-C Electrode Potentials of the Amplifier.

by FREDERICK W. SMITH, Jr.

RCA Institutes

and MARCEL C. THIENPONT

Dept. of Neurology, Neurological Institute, Columbia University

Infinite Attenuation

In contrast to the limited attenuation range provided by transconductance variation, variations in the cathode-load resistance can be employed to produce theoretically infinite attenuation without distortion. Figure 3 demonstrates the manner in which the attenuation varies with the cathode-load resistance, according to the relationship presented in equation (*4*). It can be seen that increasingly larger attenuations can be secured by reducing the size of the cathode load resistance, thus advantageously minimizing the effects of stray capacities. It is also apparent that, for a given cathode load, the attenuation varies inversely with the transconductance. Since the maximum size of the cathode-load resistance will be dictated by bias considerations, the transconductance used will determine the minimum insertion loss produced by the attenuator.

Selecting Proper Tube

Where a low minimum insertion loss is important and the attenuation range is limited as in audio-frequency applications, it is advisable to select a tube which has a high transconductance. On the other hand, in applications in which the minimum insertion loss is unimportant but which require a considerable range of attenuation, such as in radio-frequency signal generators, a low transconductance tube coupled with correspondingly larger values of cathode load resistance would be preferable. The use of larger resistance values in this case is especially important in view of the difficulty experienced in the construction of non-inductive resistors having a resistance of less than .01 ohm.

Typical Attenuator Circuit

A typical attenuator circuit utilizing the foregoing principles is shown in Figure 4. Because of its limited range, screen voltage variation is used to provide fine control of the attenuation, and

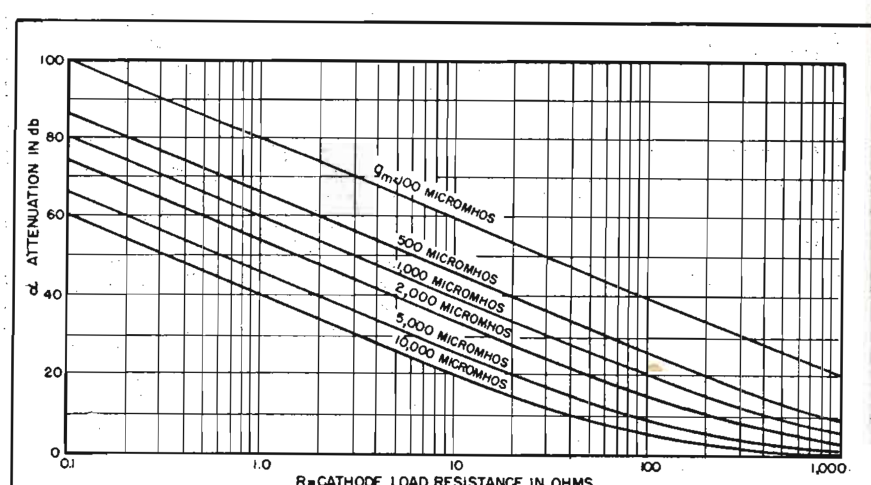


Figure 3
Attenuation introduced by an electronic attenuator.

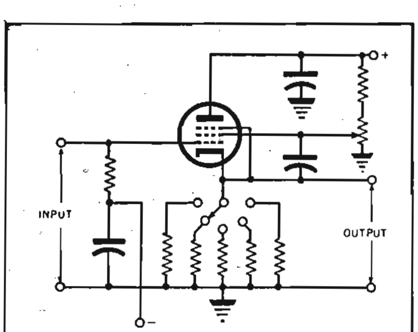


Figure 4
Typical attenuator circuit.

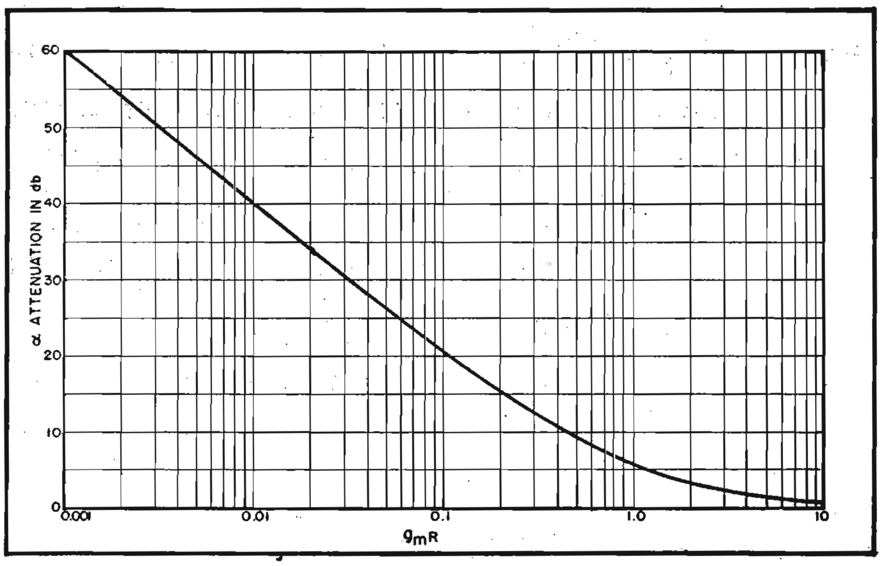


Figure 5
Universal design curve for an electronic attenuator.

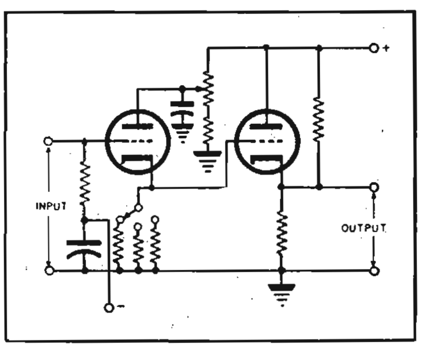
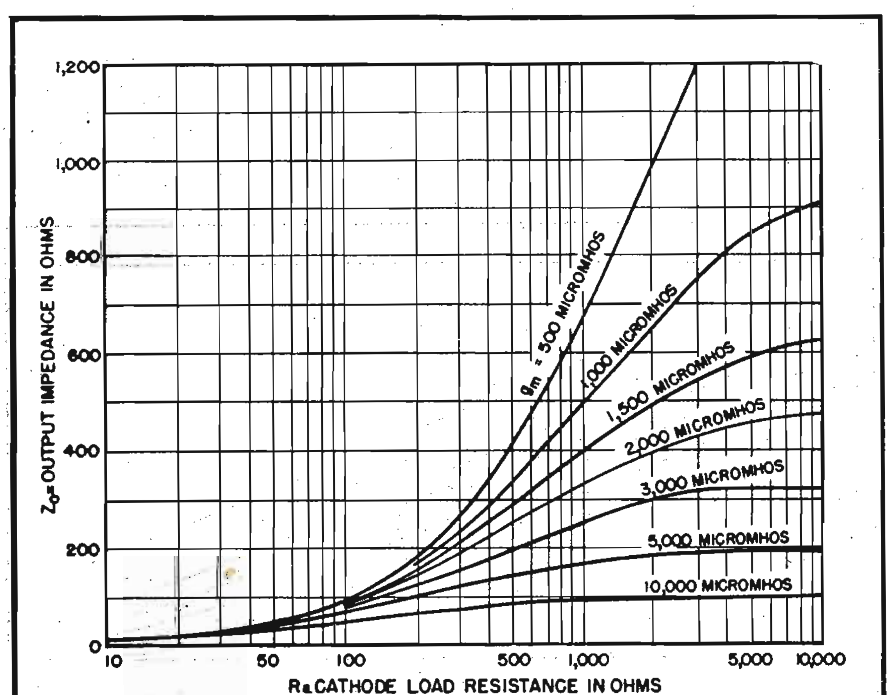


Figure 7
Electronic attenuator with buffer stage.

Figure 6
Output impedance of an electronic attenuator.



range control is secured by reducing the cathode load resistance to increase the attenuation in steps of 10 or 20 db as may be desired. The values of cathode load resistance required for these successive ranges may be conveniently obtained from Figure 5, in which the attenuation, α, has been replotted as a function of the product g_m R, to provide a universal curve suitable for design purposes.

Since the cathode load resistance will vary over a wide range, some form of fixed bias must be provided to prevent clipping of the input signal as well as excessive plate dissipation at high attenuations.

Cathode-Follower Input Impedance

As is well known, the input impedance of a cathode-follower amplifier itself is extremely high. Considering the circuit in Figure 4, it is evident that the input impedance of this type of attenuator will thus be determined principally by the value of the grid resistance employed, and such a stage may therefore be designed to either match the impedance level of the preceding circuit, or to present a practically infinite input impedance, if necessary.

The output impedance of this type of circuit consists of the internal impedance of the cathode follower in parallel with the cathode load resistance, R. Since the internal impedance is equal to $1/g_m$ when no plate or screen load (in the case of a pentode) exists[4], the output impedance, Z_o, of the attenuator may be written as

$$Z_o = \frac{R}{1 + g_m R} \qquad (6)$$

This relation is represented graphically in Figure 6. It can be seen that when R is relatively low, the output impedance will equal the cathode load resistance, and when the opposite is true, the output impedance will be very nearly the reciprocal of the transconductance.

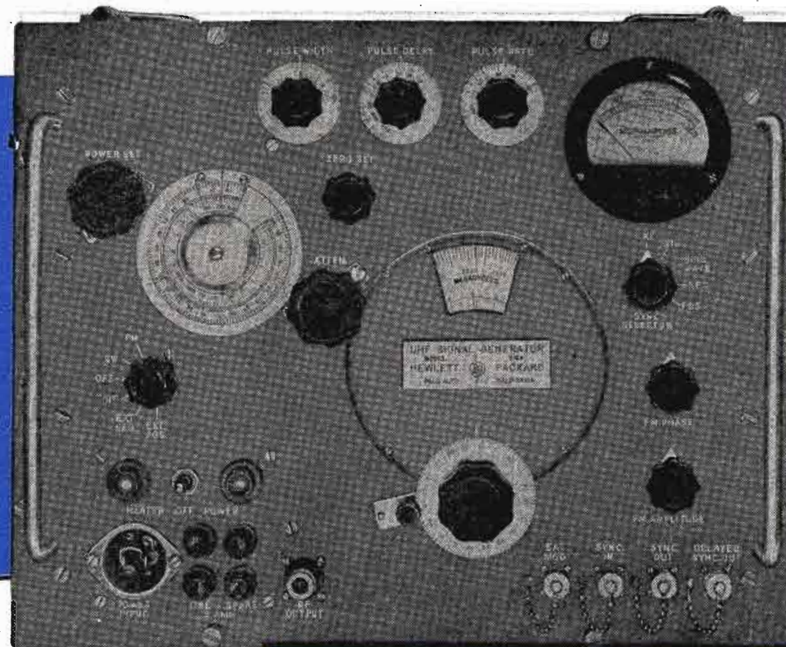
The output impedance of the circuit in Figure 4 will vary widely depending on the range of attenuation employed. In applications where a fixed, discrete value of output impedance is required, a direct-coupled cathode follower stage may be added as a buffer, to provide a constant output impedance as is shown in Figure 7.

[4]H. P. Pacini, *Cathode Follower Calculations*, Electronics; October, 1944.

hp

PROUDLY PRESENTS

MODEL 616A UHF SIGNAL GENERATOR



NOW! for the first time

Fast, direct readings 1800 to 4000 mc

Here for the first time is an uhf signal generator that combines direct reading scales, simplified controls, and c-w, pulsed, or a limited f-m output with a wide frequency range and a rugged, compact design.

Direct Reading, Direct Control

Carrier frequency in mc may be directly *set* and *read* on the large central frequency dial. R-f output from the reflex klystron oscillator is also *directly set* and *directly read,* in microvolts or db, on the simplified output dial. No calibration charts or interpolations are necessary. And because the unique coupling device causes oscillator repeller voltage to automatically track frequency changes, no voltage adjustments are necessary during operation. Even the bolometer circuit is automatically compensated for temperature changes.

C-W, F-M, or Pulsed Output

R-f output ranging from 0.1 volt to 0.1 microvolt is available. Output may be continuous or pulsed, or frequency modulated at power supply frequency. Maximum deviation is approximately ±5 megacycles. Pulse modulation may be supplied from an external source or provided internally. Pulse rate is variable between 40 and 4000 cps, and pulse width ranges from 1 to 10 microseconds. Internal pulsing may be accurately synchronized with either positive or negative external pulses, or external sine waves. R-f pulse may be delayed 3 to 300 micro-seconds with respect to the external synchronizing pulse. Output trigger pulses are also available. They may be simultaneous with the r-f pulse or delayable from 3 to 300 microseconds with respect to the r-f pulse.

Wide Range, Great Stability

A twist-of-the-wrist precision tunes the *-hp-* Model 616A to any frequency between 1800 and 4000 mc. Accuracy of calibration is within ±1% and stability is of the order of 0.005% per degree centigrade in ambient temperature. Line voltage changes of ±10% cause frequency changes of less than 0.02%.

1380

Wide Applicability

The *-hp-* Model 616A UHF Generator is ideal wherever precision ultra-high frequencies are needed for measuring purposes. Some of its many uses include determining of receiver sensitivity, signal-noise or standing-wave ratios, conversion gain, alignment, antenna or transmission line characteristics. The instrument is light and compact, occupying minimum bench space. It is unusually rugged of design for long-term, trouble-free operation. Repairs and replacements, when necessary, are made extremely easy by straight-forward circuit layout and ready accessibility of all components.

The *-hp-* Model 616A UHF Signal Generator is available for early delivery. Write or wire today for full technical details.

HEWLETT-PACKARD COMPANY
1380E Page Mill Road, Palo Alto, California
Export Agents: FRAZAR AND HANSEN
301 Clay Street, San Francisco 11, California, U.S.A.

hp laboratory instruments
FOR SPEED AND ACCURACY

Audio Frequency Oscillators · *Signal Generators* · *Vacuum Tube Voltmeters*
Noise and Distortion Analyzers · *Wave Analyzers* · *Frequency Meters*
Square Wave Generators · *Frequency Standards* · *Attenuators* · *Electronic Tachometers*

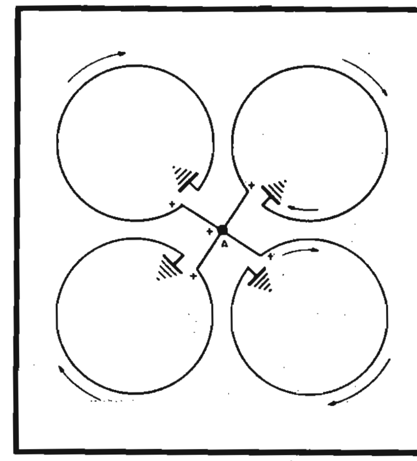


Figure 1
Basic circuit of the clover-leaf antenna, using a single feed line and a ground, or tower, return.
(*Courtesy W.E.*)

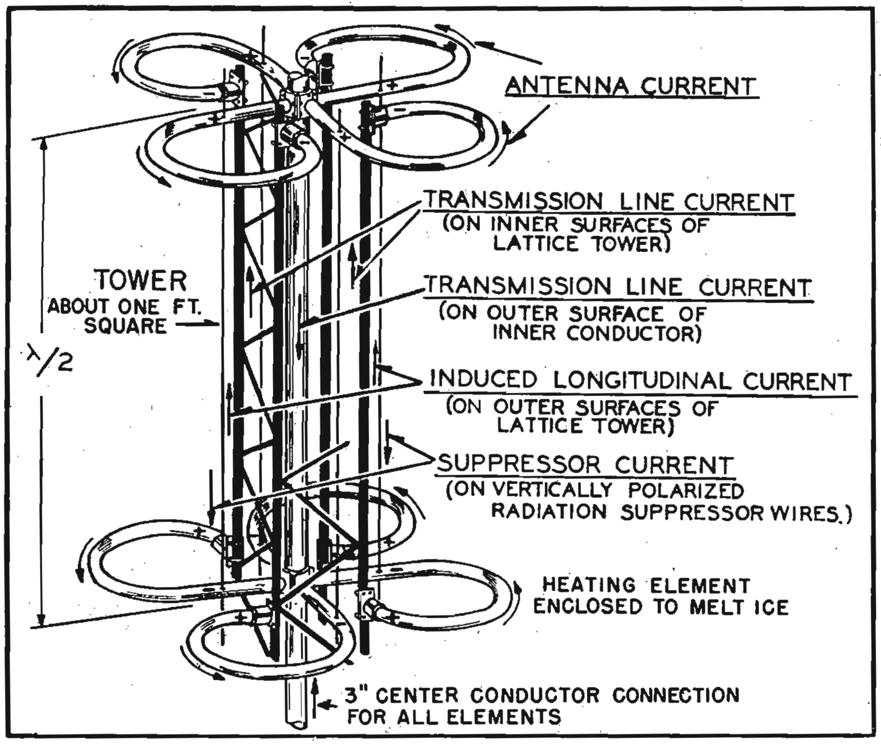


Figure 2
Construction and connections for a clover-leaf f-m antenna installed on a tower for operation in an array.
(*Courtesy W.E.*)

Antennas For F-M BROADCASTING

A HORIZONTAL LOOP can also be formed by four small loops arranged in a clover-leaf[1] pattern. The basic circuit for this type of antenna is shown in Figure 1; four similar loops placed symmetrically about point *A*, like four pennies laid on the table, with their centers forming a square. They just clear one another so that no shorts occur. The feed terminals of the loops are adjacent to *A* and all four loops are fed in parallel. For convenience, a single line feed with a ground, or tower, return is utilized. If the feed line were run up the center along *A*, all of the counterclockwise displaced terminals of the loops would be connected to the feed line at *A* and the remaining terminals grounded. Actually for symmetry they are connected together at the tower support and connected to the tower. Thus, at any instant, the currents flowing through all four loops would be in phase, as indicated by the arrows in the figure.

The currents flowing in the adjacent portions of the loops, as indicated by the two arrows in the right-center of the figure, flow in opposite directions so that in effect they cancel out leaving only the currents flowing in the outer portions. Accordingly we have a symmetrical shape, somewhat like a four-leaf clover, which produces, in effect, a ring of uniform in-phase current, the requisite of a omnidirectional loop radiation pattern.

Figure 2 illustrates the actual construction and installation of the clover-leaf antenna on a tower. The four elements, or individual loops, are fed from a center 3″ feed conductor fastened to it by means of clamps. This feed conductor would be located at point *A* in Figure 1. The opposite ends of the elements are connected to the tower, forming a tower return. The supporting tower itself is about one foot square. It is interesting to note that the heating elements are run through the antenna proper.

Because of the displacement of the loops, the added length of the feed line for each loop and spurious currents flowing in vertical members of the tower, a small vertical radiation field exists. This does not hinder reception or interfere with the radiated horizontally polarized wave, but it does lead to a loss in power, a radiated field which is not used. This vertically polarized radiation is nullified by four small diameter vertical cables connected between the clover-leaf elements.

The Slot Antenna

The slot[3] also called the pylon[4] antenna provides horizontally polarized and approximately horizontally-omnidirectional radiation. The antenna is a cylinder approximately 13′ high and 19″ in diameter with a narrow slot cut from top to bottom; Figure 3. The cylindrical structure itself is the radiator. A single transmission line running up the inside of the cylinder,

---

[1]L. C. Tyack, *The Clover-Leaf,* Western Electric Oscillator; April, 1946.

[2]Philip H. Smith, *The Clover-Leaf FM Antenna,* Report on the Sixth Annual Conference of Broadcast Engineers, COMMUNICATIONS; April, 1946.

[3]Charles R. Jones, *Slotted Tubular Antenna,* COMMUNICATIONS; July, 1946.

[4]Robert F. Holtz, *The Pylon Antenna,* RCA Broadcast News; October, 1946.

Note: The diameter of the loop antenna of Figure 2 in the last month's article on *Loop Antennas for F-M Broadcasting,* April 1947, should have been λ/2π which, in the discussion, would be a loop of about 20″ diameter at 100 mc.

Part II of an Analysis of F-M Antennas. Discussed Are the Principles of Operation and Construction of the Clover-Leaf, Slot and Turnstile Antennas.

by N. MARCHAND*

Consulting Engineer
Lowenherz Development Company

along the slot to the midpoint, is the feed line.

The cylinder is rolled from a single sheet of metal. It is capped on each end with a cast base giving it great mechanical strength and providing a means of connecting it to the supporting tower or to additional stacked elements.

The operation of the antenna can best be understood by considering, first, a thin horizontal section of the cylinder as shown in Figure 4*a*. This thin section is actually a horizontal loop antenna fed by the voltage across the slot. It has to be treated as an ordinary loop and should not be too large in diameter; otherwise, an omnidirectional horizontal pattern would not be obtained. The edges of the slot itself can be considered as an open-wire transmission line shorted at the ends by means of the caps and inductively loaded by the loops that comprise the cylinder. (The voltage distribution along the slot for a one-wavelength cylinder is shown in Figure 4*b*.) Thus the voltage is simultaneously impressed on the radiating elements all along the cylinder and, since in a shorted transmission line the voltage is everywhere in-phase, the loops are all impressed with in-phase voltage and are radiating in-phase. This is shown schematically in Figure 5; individual loop elements are shown as dotted lines. The circumference of a horizontal section of the cylinder is chosen to be about one-half wavelength in the center of the f-m band. When the currents all flow it forms, in fact, a veritable sheet of current flowing horizontally around the cylinder.

The horizontal radiation pattern of the antenna is shown in Figure 6. It will be noticed that the radiation pattern becomes more directional as the frequency is increased. This follows the theory covering a loop antenna. Theoretically, for a perfectly omnidirectional pattern it is only necessary to sufficiently decrease the diameter of the cylinder; but, of course, this would greatly decrease the radiation resistance of the antenna while the actual gain in db in the lower field strength portions of the pattern would be small. Figure 7 shows the standing wave ratio obtained in the f-m band on a 51.5-ohm line; with one size radiator the antenna can cover the whole f-m band. No tuning or adjusting will be required either on the ground or in the air.

Mechanically, the antenna is a single-element self-supporting structure which is easy to erect, being simply bolted together by means of bottom flanges to the building, tower or other structure. Additional sections may be stacked on top by means of bolting flanges also. A single antenna is quite low in weight, weighing only about 350 pounds. There are negligible ice problems because the transmission lines are run inside the cylinder where ice formation is unlikely.

The Turnstile Antenna

The turnstile antenna is another method which has been successfully used for the production of horizontally polarized radiation in an omnidirectional horizontal pattern. It consists fundamentally of two half-wave dipole antennas placed at right angles to one

*Instructor in Graduate Electrical Engineering courses, Columbia University.

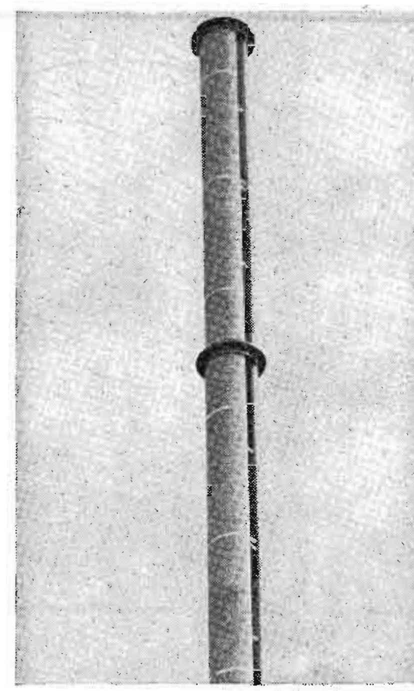


Figure 3 (Top, right)
The slot (pylon) antenna; a cylinder with a narrow slot cut from top to bottom and capped at each end with a conducting cast base.
(Courtesy RCA)

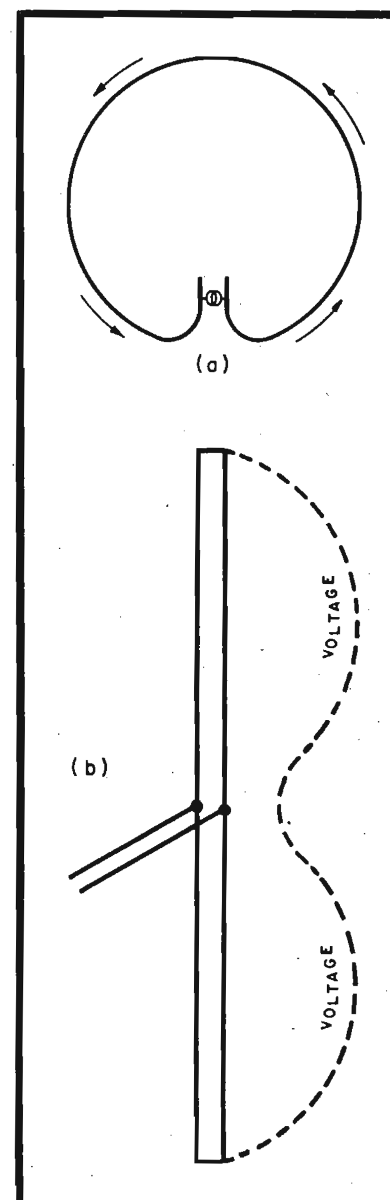


Figure 4 (Right)
Current flowing in a thin horizontal section of the slot antenna and voltage distribution along the slot in an antenna one-wavelength long.
(Courtesy RCA)

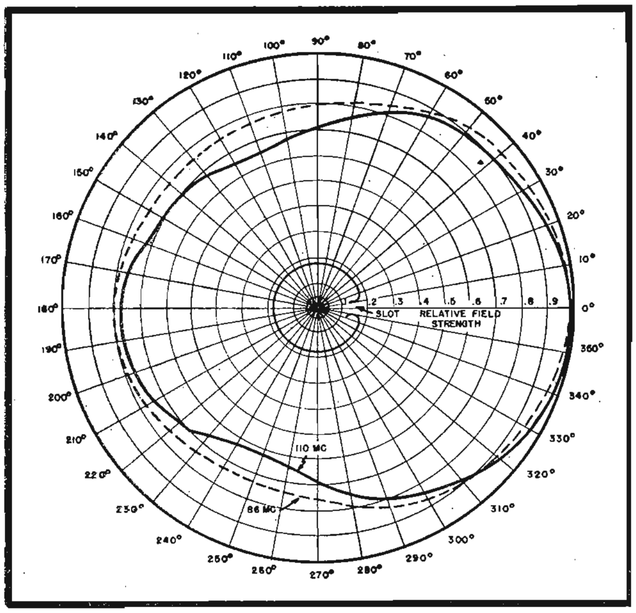


Figure 6
Horizontal field pattern of a slot antenna for frequencies at either end of the f-m band.
(Courtesy RCA)

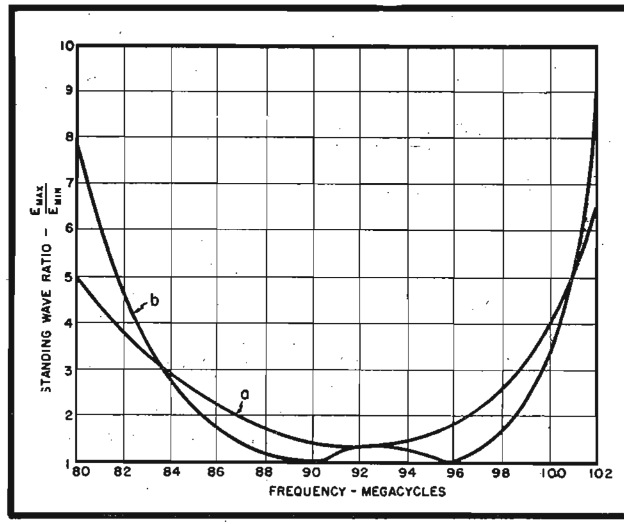


Figure 7
Variation of the standing-wave ratio on a single-section slot antenna between the frequencies of 80 to 102 mc. At *a*, for direct connection of line to antenna; *b*, with stub-matching section.
(Courtesy RCA)

another and fed with currents 90° out of phase; Figure 8.

Operation Analysis

Let us call the current fed to one antenna I_o and the current in the other antenna $I_o\underline{/90°}$, being 90° displaced in phase and equal in amplitude to the current in the first antenna. The two radiated fields in the plane of the two antennas, E_1 and E_2, would be approximately,

$$E_1 = KI_o \sin \Theta \sin \omega t \qquad (1)$$
$$E_2 = KI_o \cos \Theta \cos \omega t$$

where ω is equal to 2π times the frequency being used, Θ is the reference angle, and K is the radiation factor determined by the distance from the antenna to the receiver.

Taking the sum of the two radiated fields, we obtain the total field, E_t, where

$$E_t = KI_o \cos (\omega t - \Theta) \qquad (2)$$

Thus, in the ideal case where the radiation patterns can be assumed sinusoidal in shape, the resultant radiation pattern is omnidirectional. In the actual case the field drops off about 10% at 45° to the antennas and results in a slight "squaring" of the pattern; Figure 9.

To obtain a wide band effect, folded dipoles are used as the elements of the turnstile. With folded dipoles it is possible to obtain a substantially constant and resistive impedance over a

(Continued on page 36)

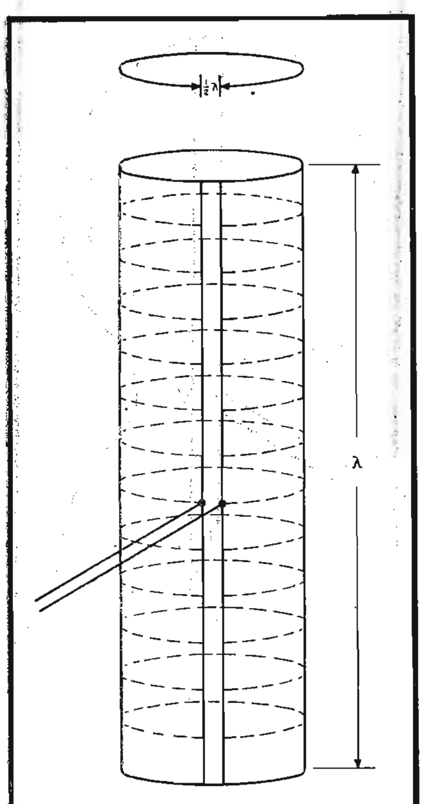


Figure 5 (Left)
A graphical representation of the slot antenna which may be considered as being made up of a large number of circular elements.
(Courtesy RCA)

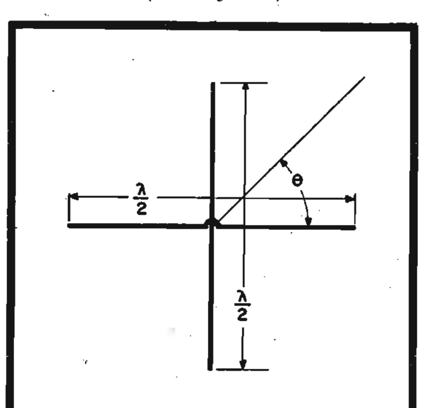


Figure 8 (Below)
Fundamental half-wave turnstile antenna consisting of two half-wave dipoles at right angles to one another and fed 90° out of phase.

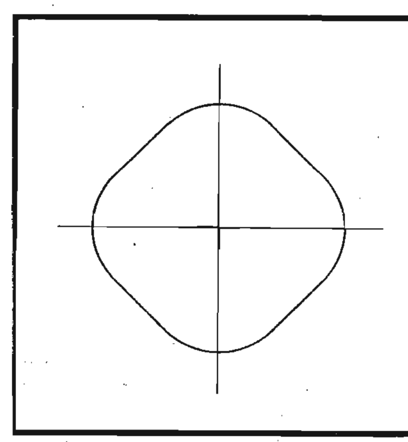


Figure 9 (Right)
Radiation pattern of a half-wave dipole turnstile antenna in the plane of the antenna.

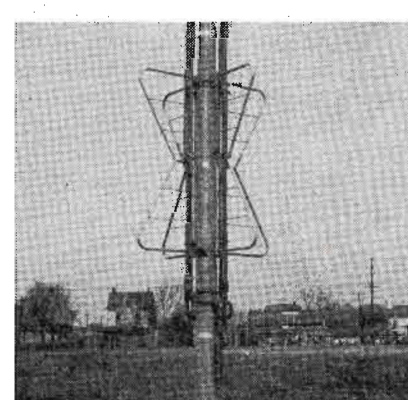
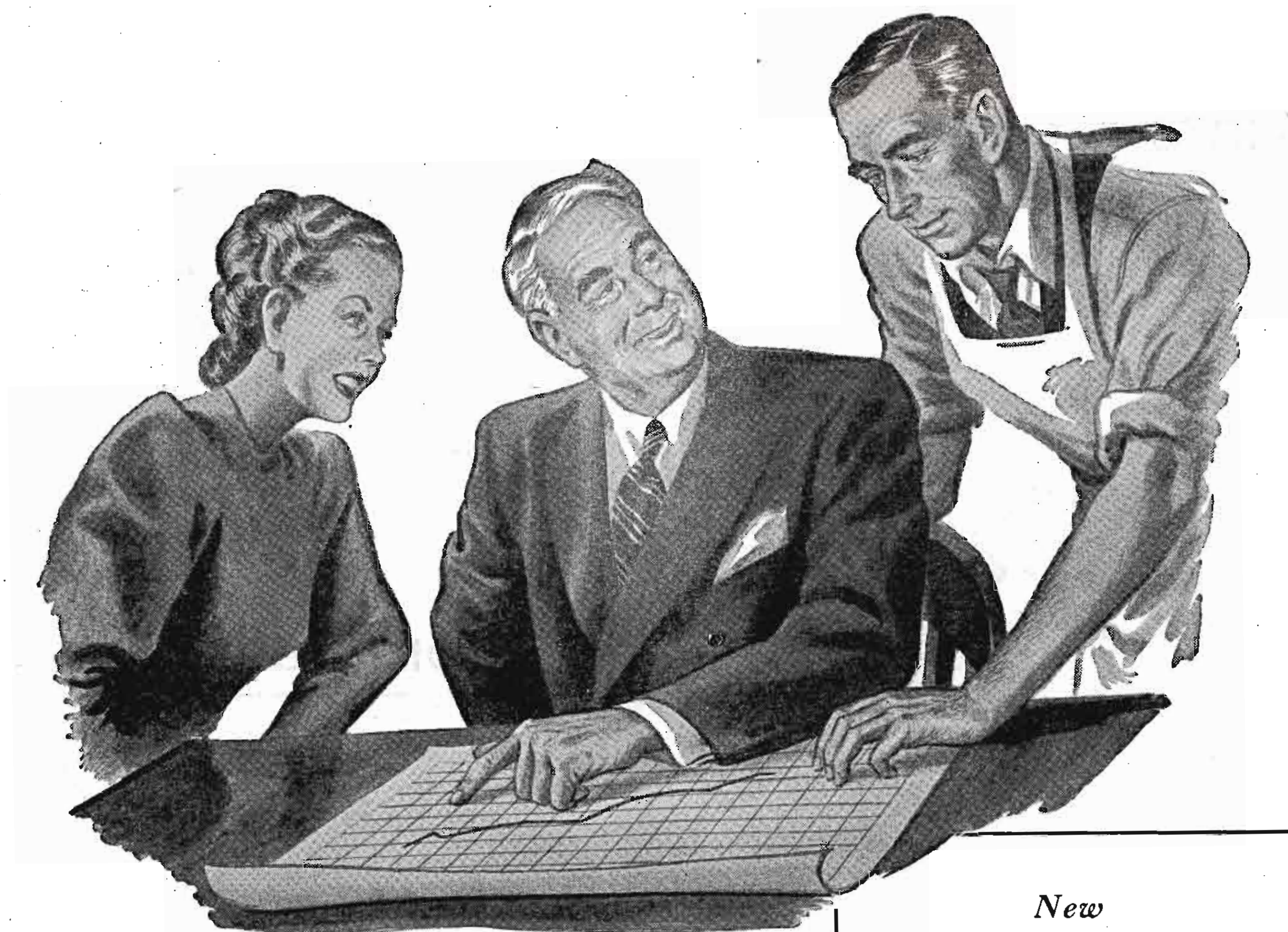


Figure 10 (Right, below)
A super-turnstile antenna using current sheet radiators.
(Courtesy RCA)

ARE YOU STILL AN ACTIVE PARTNER...



in this "7½ billion-a-year" success?

NEVER was there a partnership like the nation-wide brotherhood of volunteers who have helped sell, advertise, and promote sales of U. S. Savings Bonds! Their program is the greatest sales operation at the lowest cost in history.

Your continued support in promoting the Payroll Savings Plan will help "America's partnership" this year to repeat or surpass last year's four-star performance, in which sales of Savings Bonds were 7½ billion dollars—*exceeding redemptions by far more than a billion!*

So keep up the splendid work—keep on telling and selling your employees the advantages of Payroll Savings: (1) ease; (2) regularity; (3) safety of investment; (4) security for the individual and the nation; (5) $4 for every $3 at maturity! And, remember, people with a stake in the future are the most stable, most productive employees.

For any help you need in conducting the Plan, call on your State Director of the Treasury Department's Savings Bonds Division.

New Savings Bonds Plan won't affect the P.S.P.

THE Treasury Department and the banks of America are making it possible for farmers, doctors, and other self-employed people to participate in "automatic" Bond buying by special arrangement with their banks. This extension of the Savings Bonds program is not a partial payment plan and is intended *only* for people who are not in a position to take advantage of the Payroll Savings Plan.

The Treasury Department acknowledges with appreciation the publication of this message by

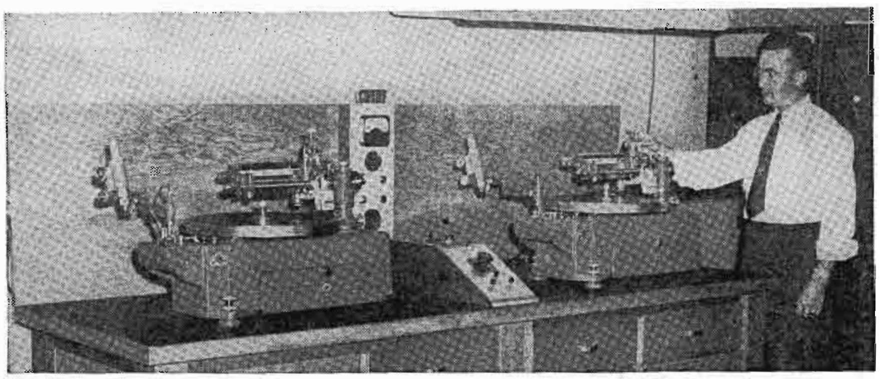
COMMUNICATIONS

This is an official U.S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

RECORDING ROOM DUAL-UNIT Switching Setup

by **ARTHUR R. O'NEIL**

Engineering Department
WSBT-WSBF
South Bend, Indiana



Scott Hagenau with the recording switching setup, for which he designed the mechanical layout. The control panel is hinged on the right side and swings open for access to the relays and switches mounted on the bench. The intercom is located in one of the drawers and the remainder of the equipment, amplifiers, relay power supply, etc., is located in the racks at the right. The gain control is the large knob on the sloped panel and the buttons for operating the relays are immediately below. The center button is the reset button. The lower left button is the head and equalizer button for the left table or both tables if recording in the simultaneous position. Right button is for the right table.

Simplified Control Unit, Adapted to Dual Recorders, Permits Switching from Table to Table, Control of Recorder Gain and Master-Control Intercommunications System.

RECENTLY A PAIR OF new recorders[1] were purchased for our recording room. In preparing for the installation, it was decided to provide for a simplified method of control so that switching from table to table, and control of recording gain and master-control intercom would be available from one convenient position close to both tables. We found that such control could be worked in with a relay switching system; Fig. 1.

Accordingly, plans were made for the mounting of the recorders on one large table.[2] Provision was also made for a small control desk and meter panel to carry the switching system. On the motor panel, a v-i was installed and connected so that it would read amplifier output level as applied to the recording heads. Just below the v-i and its associated control, signal lights were installed to indicate which equalizer slider and which recording head is operating; red lights for the heads and green for the equalizer. A speaker for the intercommunication system was placed immediately below the signal light.

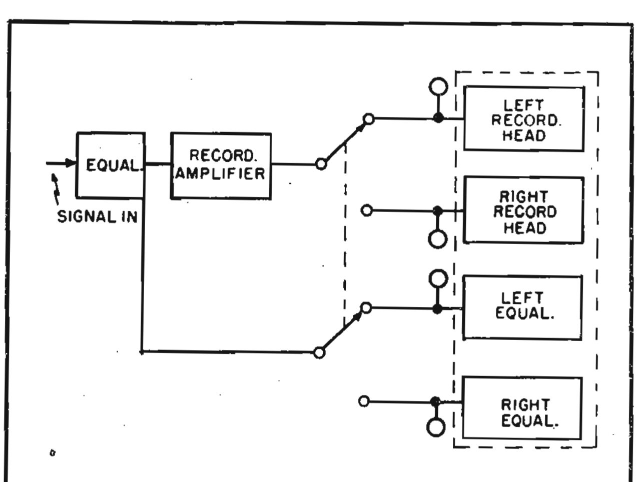
The new recorders feature an automatic equalizer whose control must be inserted into the amplifier at the same time the head is connected to the amplifier, except when recording simultaneously and then only a slider on one table is required. To provide for this, we included an equalizer switch and a

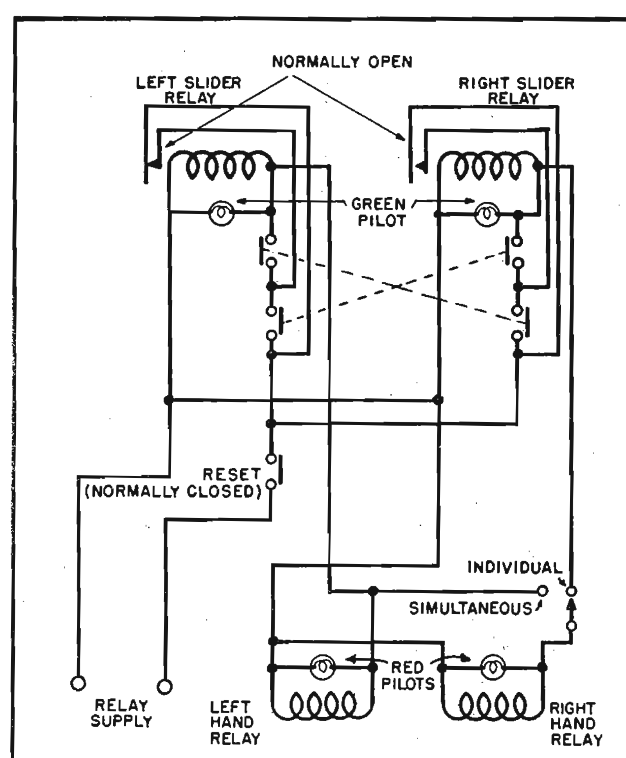
(*Continued on page* 36)

[1]Presto 8D.

[2]Sufficient drawer space was allotted for the storing of blanks, recording spares, styli, etc.

Figures 1*a* (left, below) and 1*b* (right, below) Block diagram of the switching arrangement is shown in 1*a*. Figure 1*b* is a diagram of the relay-switching system. Holding contacts are the only ones shown.





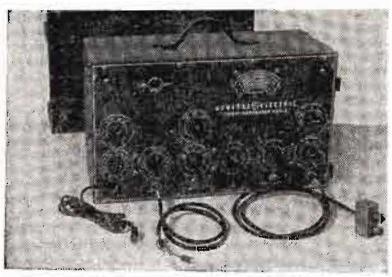
The Industry Offers

G.E. V-H-F SIGNAL GENERATOR

A v-h-f signal generator, type YGS-3, combining four basic units into one instrument to supply r-f and a-f signal voltages for aligning a-m and f-m receivers, has been announced by the specialty division of G. E.

An r-f oscillator, an f-m oscillator, a 1-mc crystal calibrator and a variable-frequency audio oscillator are in the generator; eight types of output available . . . unmodulated r-f; r-f plus crystal; audio fixed; audio variable; modulated r-f; modulated crystal; f-m (100 kc to 200 mc); unmodulated crystal.

Fundamental frequency range of the r-f oscillator is 100 kc to 150 mc, while the f-m oscillator operates with center frequencies of 1, 20 and 50 mc.



* * *

SYLVANIA POCKET-SIZED OHMMETER

A pocket-sized ohmmeter for spot checking has been announced by the radio tube division of Sylvania Electric Products, Inc., 500 Fifth Avenue, New York 18, N. Y.

Ohmmeter is enclosed in a tubular plastic case ⅞" in diameter and 5¾" overall. The prod tip base and top cap, constructed of bakelite, are mounted in a transparent cellulose-acetate tube housing the meter.

Direct readings between 0 and 10,000 ohms are given on a 1.5 ma full-scale sensitivity meter in series with a 1000-ohm molded carbon resistor and a standard penlight dry cell. Test electrodes include a stainless steel prod built into the meter case and one secured to the tip of a 17" test cord.

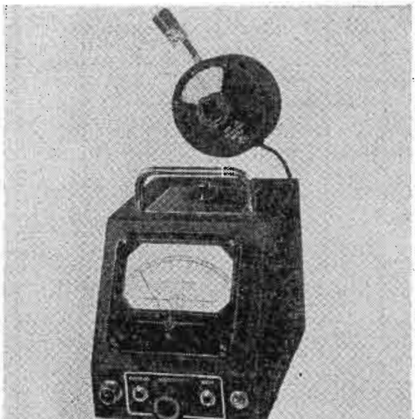
* * *

MEASUREMENT CORP. MEGACYCLE METER

A 2.2 to 400-mc meter, megacycle meter model 59, which can be used to determine the resonant frequency of tuned circuits, antennas, resonant circuits and measure Q, mutual inductance, capacitance, etc., has been developed by the Measurements Corp., Boonton, N. J.

Modulation, c-w or 120 cycle fixed at approximately 30% at 15 mc, or external.

Uses one 955 oscillator, VR-150/30 regulator and 5Y3GT rectifier.



HAMMARLUND 20-WATT TRANSMITTER

A 20-watt ham transmitter, Four-20, and a modulator, Four-11, have been announced by the Hammarlund Mfg. Co., Inc., 460 W. 34th St., N. Y. City 1.

Transmitter features mono-sequence tuning, which is said to provide for the tuning of four different but harmonically related frequencies, with a single control.

Transmitter has a 7C5 crystal oscillator, three 7C5 multipliers, and an 807 final amplifier.

Modulator incorporates push-pull 7C5s in final stage.

Lloyd A. Hammarlund, president of Hammarlund Mfg. Co., Inc., at the controls of ham transmitter.

* * *

LANGEVIN PROGAR

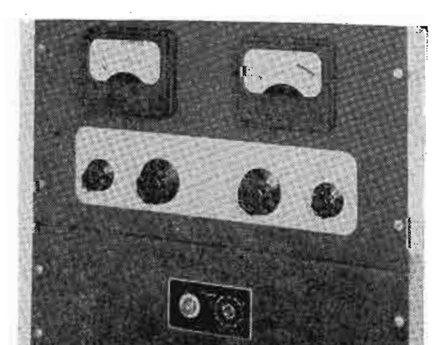
A program guardian, employing a peak limiter preceded by an automatic gain-control amplifier with variable time constants, Progar 119A, has been announced by the Langevin Company, 37 West 65 Street, N. Y. 23, N. Y.

In operation, normal signals pass through guardian and peak-limiter sections with no change. In the event the program level increases, however, the peak-limiter section reduces the increase, maintaining the original level while introducing no appreciable change in wave form. Following this action, the guardian section reduces the gain of the guardian circuit to meet the new level requirements, thereby permitting the limiter to restore to normal.

In the event the average program level decreases, the guardian section registers the decrease in its memory portion. Corrective action is not taken immediately, but after a predetermined, adjustable period of time, the gain of the guardian section is gradually increased so as to restore the original level.

Designed so that it will not affect the dynamic expression of the program material even though the dynamic range may be controlled by the amount of compression (adjustable) employed in the limiter section.

Input level, −31 dbm normal and adjustable to +10 in steps of 2db; output level, +24 dbm with less than 1% total harmonic distortion from 50 to 15,000 cps; gain, normal 55 db.



PARA-FLUX REPRODUCERS

Three types of reproducers for vertical lateral and universal uses, para-flux reproducers, have been announced by Radio-Music Corporation, East Port Chester, Conn.

Vertical head, VL-1DA, has a diamond stylus with a 2-mil radius.

Lateral head, LL-1DA, uses a 2.5-mil radius stylus.

Universal head, UL-1DA, employs a diamond stylus, 2-mil radius.

Response of all models is said to be linear from 40 to 11,000 cps.

Vertical, lateral and universal heads use same arm and equalizer. Head can be removed and replaced via a plug connection.

Bulletin PR5 mailed upon request.

* * *

RCA TUBES

A u-h-f triode, tv camera tube and f-m power triode have been announced by RCA. The u-h-f tube is a forced-air-cooled, grounded-grid triode, 5588. Has a maximum plate dissipation of 200 watts, and can be operated with full plate voltage and plate input at frequencies up to 1200 mc.

Features a coaxial electrode structure, affording use with circuits of the radially spaced, coaxial-cylinder type.

The camera tube, 5527, has a mosaic diameter of 1.4"; resolution capability is about 250 lines. Tube is 9" long. Can provide a satisfactory picture when the incident light level is 500 to 100 foot-candles.

The power triode for F-M transmitters, 9C26, is a forced-air-cooled, radiator-type triode intended primarily for use in 10-kw transmitters. Features metal-header construction, complete shielding between filament leads and plate, thoriated tungsten filament. Tube can be used in grounded-grid circuits.

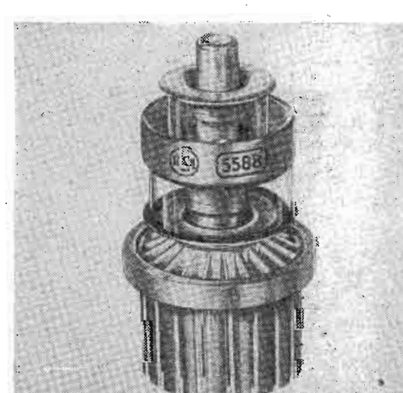
Has a maximum rated plate dissipation of 7.5 kw. In unmodulated class C applications at frequencies up to 30 mc, it has a maximum input rating of 20 kw.

Other tubes recently announced by RCA include the 1P42, 3C33, 12AU7 and 35B5.

The 1P42 is a *head-on* high-vacuum phototube. Diameter ¼". Semi-transparent cathode surface on the glass window in the large end is sensitive to light sources predominating in blue radiation.

The 3C33 is a power amplifier with two high-perveance triode units in a single-ended construction. Anodes have radiating pins to in-

(Continued on page 39)



Federal's Aircraft Antenna Wire

REDUCES
PRECIPITATION STATIC

WHAT IS PRECIPITATION STATIC?

To the pilot, it's the ear-splitting noises he hears on his radio — frying sounds, intermittent crackling, moans and shrieks. It is caused by corona discharge (St. Elmo's Fire) of static potentials accumulated on a plane flying through rain, snow or dust, or near charged clouds — via protuberances on the aircraft surfaces including exposed antenna wires. This corona discharge is sometimes visible as a bluish halation radiating from the extremities of the plane, and it is the discharge *from the antenna* that is the first source of radio interference.

HERE'S A PRACTICAL, low-cost means of reducing precipitation static, a major flying hazard because it strikes when radio aids are needed most — in bad weather.

Working in close cooperation with the U. S. Army Air Technical Service Command and U. S. Navy, Federal has developed and perfected a quality *insulated* antenna wire which, together with proper antenna hardware, reduces precipitation static. This wire, Intelin Type K-1064, AN designation WS-5/U, has proved highly effective in actual service on U. S. Army and Navy planes. As a result of this service experience it has been adopted widely by the domestic airlines, and is now available for use on privately owned aircraft.

The copperweld conductor gives high tensile strength, and the durable, weather resistant polyethylene insulation assures long service life, even under the most severe conditions. Federal's Aircraft Antenna Wire can be obtained in the Type K-1064, designed to U. S. Army and Navy Specifications. For information, write today to Dept. D710.

DATA

Federal's Intelin High-Strength Aircraft Antenna Wire Type K-1064

OUTSIDE DIAMETER

	Conductor	Insulation
Nominal	0.0508″	0.183″
Minimum	0.0498″	0.178″
Maximum	0.0518″	0.188″

MATERIALS

Conductor — #16 AWG H.S. Copperweld (30% Conductivity)
Insulation — Polyethylene (semi-transparent)

TENSILE STRENGTH

127,000 psi minimum

Federal Telephone and Radio Corporation

In Canada: — Federal Electric Manufacturing Company, Ltd., Montreal.
Export Distributors: — International Standard Electric Corp. 67 Broad St., N. Y.

100 Kingsland Road, Clifton, New Jersey

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

W. J. McGONIGLE, President — RCA BUILDING, 30 Rockefeller Plaza, New York, N. Y. — GEORGE H. CLARK, Secretary

Personals

John J. Massiello, a genuine old-timer continues to be active in VWOA affairs. . . . E. L. Schacht, in commercial radio since 1936, who has been with Bendix and RCA International Division, recently relinquished his majority in the Army. . . . A. B. Tyrell, aboard ship in 1916, was in the Navy from '17 to '19, then with RCA engineering from 1920 to 1929, and foreign representative for RCA until 1946. . . . Chester R. Underhill, a veteran of the Leviathan, served at numerous coast stations. . . . F. K. Bridgeman started 'way back in 1923. . . . H. J. Buckley in 1920 was aboard Great Lakes steamers and later served aboard East coast vessels. . . . F. E. Golder, who saw his first shipboard installation in 1921 and then took on numerous seagoing assignments, has settled down to a shore broadcast job with NBC in Chicago. . . . L. O. Gorder is now with the American Television Laboratories. . . . R. J. Higgins, radio officer aboard the S.S. Carolina in 1924, is now at RMCA in the windy city. . . . E. A. Beane, a 1912 veteran of the Massie Wireless Telegraph Company, who also served with Marconi Company, is presently located in Chicago. . . . L. W. Bear, chairman of the Chicago chapter of VWOA, began his ship days in 1923. . . . C. G. Crose, a 1922 veteran, saw service aboard the S.S. Australia, the Philadelphia and many others. . . . W. H. Cummings was aboard the S.S. Ingales in 1925 and then went to the S.S. Amazon. He began his *ground* activities at the Dodge Radio Institute at Valparaiso, Ind., and then went to NBC. He is now at ABC. . . . Ero Erickson, in radio since 1931 on the Great Lakes, and at present with the Illinois State Police, is secretary-treasurer of APCO. . . . Franklin A. George, a *Laker* in 1924, was with Intercity 1926 to 1928, and still is in radio. . . . John Gause, aboard the Eastern Glade in 1929, served aboard many Lakers. . . . H. H. Guthmann started in 1920. . . . C. E. Holst, in 1933 with Chicago Police Department, went to TWA for plane service and now is a landlubber with TWA. . . . A. B. James, in 1938 with RMCA, then Allied Radio and American Airlines is now with RMCA. . . . J. J. Kurilla, a granddaddy, since 1912, served with the U. S. Navy in World Wars I and II. . . . G. I. Martin, former chairman of the Chicago chapter and now chairman of the membership committee of the Chicago chapter, began his radio operating career in 1914. He has served aboard the S.S. Esperanza, Commeujne (a Dutch passenger ship aboard which Ye Prexy also served), Santiago, Mexico, Santa Marta, and the Resolute. At present he is in charge of the Radiomarine office in Chicago. . . . C. F. Nehlsen was a Laker from 1921 to '25 and then into the broadcasting field with WLS in Chicago. He is still there. . . . Peter Rice, aboard ship in 1923, continued seagoing until 1930 and then with the Chicago Police where he continues to be active. . . . R. K. Davis, of the New York staff of Tropical Radio Service Corporation, is now sojourning at Alberquerque, New Mexico. Best of health to you RKD. . . . C. M. Hodge who served many years in the Persian Gulf area is now stationed in San Francisco, Calif. . . . R. C. J. O'Keefe has returned to Brooklyn after considerable overseas duty. . . . J. W. Graham continues to reside in Woburn, Mass. . . . P. L. Stocum, formerly of Portland, Oregon, is now stationed at Moses Point, Alaska, with the CAA. . . . L. C. Herndon, who has served in many FCC field offices, is now in Chicago. . . . Colonel E. C. Page, formerly engineering director of the Mutual Broadcasting System, has established a consulting practice. . . . S. W. Fenton, long associated with the I. T. and T. affiliates, is now representing them at Bombay, India. . . . T. M. Gardner, with RMCA in Portland, Oregon, is active in the formation of a VWOA chapter in that city. . . . M. H. Romberg, in 1914 with the Marconi Company, served with the University Broadcast Council and is now with WBBM in Chicago. . . . E. P. Shandy, a shipboard operator in 1921 and for many years with RMCA, now serves that organization in Chicago. . . . E. J. Webster, of the Chicago Chapter, started in 1929 with WGO, RCA coastal station. . . . Sam Wise, a Marconi operator in 1916, was with Independent Wireless and saw service on numerous vessels under the Mexican flag and in the broadcasting industry. . . . N. W. Zacharias, a genuine pioneer, continues his active VWOA work. . . . William A. Breniman, a veteran since 1919, has been a Mastonian operator and member of the CAA. Today he is chief of the operating division of the CAA in Chicago. . . . E. W. Mayer was at WPR at Enseneda, Puerto Rico, in 1919. His next assignment was with Pan Airways. At present he is with CAA in Puerto Rico at San Juan. . . . C. A. Smith is with Radio Aviation office at Monckton, New Brunswick, Canada. He is a Canadian Marconi pioneer.

Commodore E. M. Webster, honorary member of the VWDA, who recently became a FCC Commissioner.

Congratulations

We were certainly proud to learn of the appointment of our distinguished honorary member, Commodore E. M. Webster, as FCC Commissioner. He was formerly Chief Communications Officer of the Coast Guard, and more recently director of radio and electronics for the American Federation of Shipping. He has also served the FCC as assistant chief engineer.

5-31-47

SOCKETS AND SHIELDS...

for miniature button base tubes

These new National sockets are of mica-filled natural molded Bakelite with silver-plated beryllium-copper contacts — designed for maximum dependability and adaptability. The contacts — either axially or radially mounted and removable for replacement — provide short leads and low inductance so vital to ultra-high frequency design. Sockets are built to JAN specifications — can be used with or without shields.

Made in three sizes to accommodate the various sizes of miniature tubes, the shields are of nickel-plated brass, with cadmium-plated phosphor bronze spring to provide correct tension to hold both tube and shield in place regardless of angle or vibration. Shield bases are of nickel-plated brass, with two 4/40" spade bolts mounting both socket and shield base.

You'll find hundreds of other parts, both new and old, to improve your apparatus in the new 1947 National Catalog.

National
EST. 1914

NATIONAL

COMPANY, INCORPORATED

MALDEN, MASS.

MAKERS OF LIFETIME RADIO PRODUCTS

Radiation Chart For F-M Stations

Chart, for Computing Effective Radiated Power, Provides a Visual Analysis of the Problem of Determining the Most Desirable Combination of Equipment.

by CHARLES F. GUTHRIE

Assistant Engineer
Andrew Company

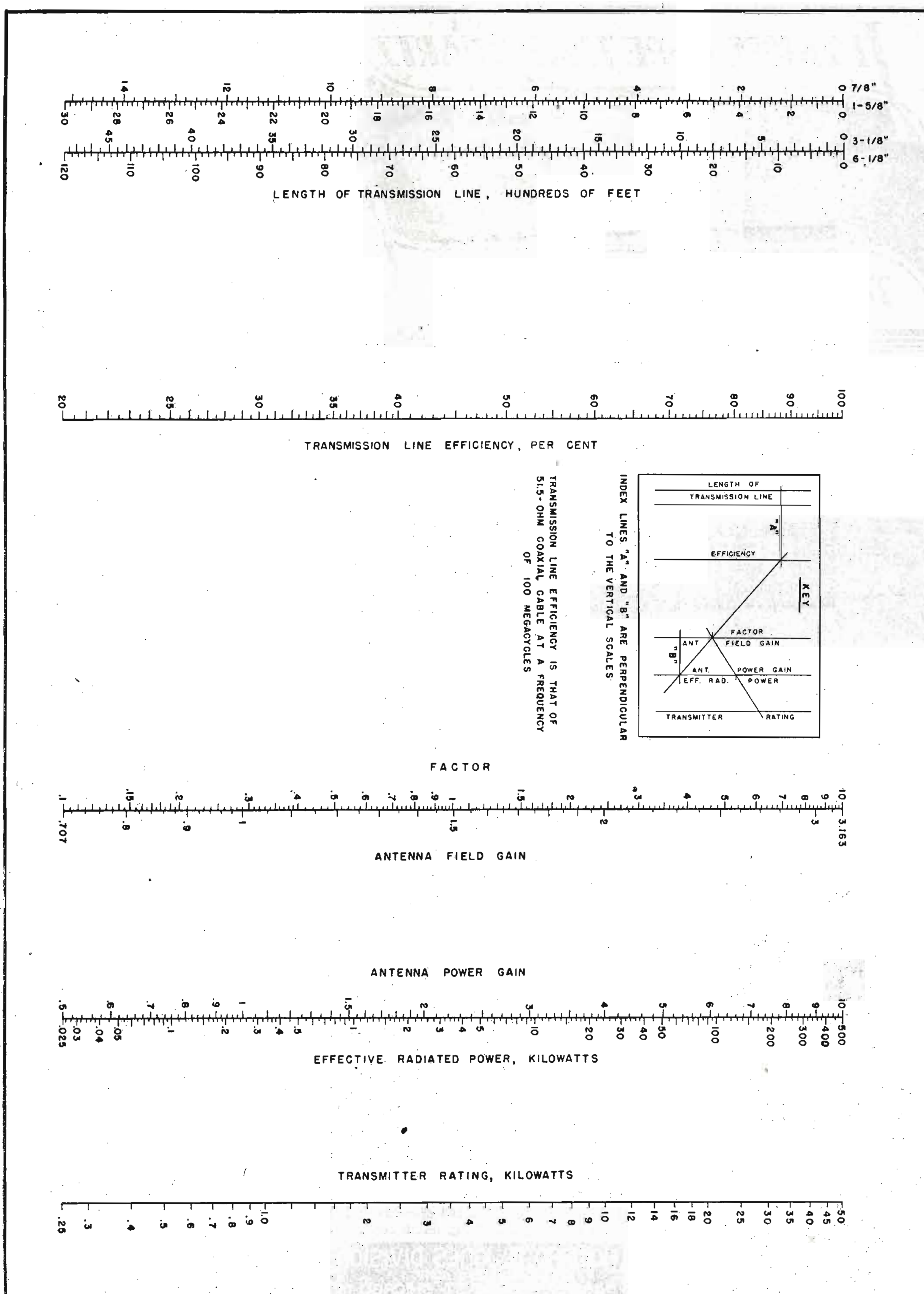
In the November, 1945, issue of Communications Frederick C. Everett presented a very convenient range-prediction chart for f-m stations. One of the parameters of that chart is *effective radiated power*.

To compute this power, the chart shown in Figure 1 was constructed. Several factors were considered during the processing of the chart. Transmitter rating and antenna gain are, of course, available from manufacturers' data sheets. Transmission-line efficiency usually must be derived from curves showing db loss per unit length. And for a given effective radiated power, it is usually possible to use any one of several different combinations of transmitter rating, antenna gain, line size and line length. The chart (Figure 1) facilitates the visual analysis of the problem of determining the most desirable combination of equipment.

The antenna power gain is read at the intersection of a horizontal line through the proper figure on the field-gain scale. Similarly, the transmission line efficiency is read at the intersection of a horizontal line through the appropriate transmission-line dimensions. The product of the power gain and line efficiency is read where a line connecting them intersects the factor scale. The effective radiated power can then be read where its scale is intersected by a line through the factor

(Continued on page 36)

Figure 1 (Right)
The radiation chart for f-m stations.


7/8"
1-5/8"
3-1/8"
6-1/8"
LENGTH OF TRANSMISSION LINE, HUNDREDS OF FEET
TRANSMISSION LINE EFFICIENCY, PER CENT
TRANSMISSION LINE EFFICIENCY IS THAT OF 51.5-OHM COAXIAL CABLE AT A FREQUENCY OF 100 MEGACYCLES
INDEX LINES "A" AND "B" ARE PERPENDICULAR TO THE VERTICAL SCALES
KEY
LENGTH OF TRANSMISSION LINE
"A"
EFFICIENCY
FACTOR
ANT FIELD GAIN
"B"
ANT. POWER GAIN
EFF. RAD. POWER
TRANSMITTER RATING
FACTOR
ANTENNA FIELD GAIN
ANTENNA POWER GAIN
EFFECTIVE RADIATED POWER, KILOWATTS
TRANSMITTER RATING, KILOWATTS

F-M Radiation Chart

(*Continued from page* 34)

and the rated power of the transmitter.

Since the power gain claimed by antenna manufacturers is not always equal to the square of the field gain claimed, and since in f-m applications the FCC asks for the square of the field gain, it is recommended that the manufacturer's field gain figure be used, especially since this is the quantity originally determined in most antenna measurements.

The transmission line efficiency will vary somewhat with the frequency. For frequencies other than 100 mc, on which this chart is based, and transmission line lengths up to 500′, the results obtained from the chart will be more than 95% accurate at either limit of the f-m band for the least efficient size of line. This order of accuracy is ample for preliminary work.

As is the case with most nomographs, any one of the variables can be determined when the rest are known.

•

Recording Switching Setup

(*Continued from page* 29)

switch for changing from simultaneous to individual recording.

The equalizer furnished with the recorder has a standard NAB characteristic for instantaneous lateral recording. It is unique in that equalization is inserted at the proper point by a slider potentiometer operated by the same mechanical force as the recording head. The gain is also compensated at this point by another slider. The relay control provides for switching of the sliders when the heads are switched.

•

F-M Antennas

(*Continued from page* 26)

wide-frequency range so that any transmitter distortion caused by load variations are minimized.

An improved type of turnstile antenna, the super turnstile,[5] Figure 10, uses current sheet radiators as the radiating elements. They are not actually solid sheets of metal but are constructed of tubing in a framework which closely approximates the effect of a solid sheet. This design aids in cutting down the wind resistance which would otherwise be very large. It is a known phenomena that the use of large radiating elements increases the obtainable bandwidth and, in the case of the super turnstile, the bandwidth covered more than adequately covers the entire f-m band so that no field adjustments need be made.

The current sheets are fastened directly to the tower at the top and bottom of the sheet creating a slot between the tower and the sheet. The transmission line is then connected so that its outer conductor is attached to one current sheet and the inner conductor attached to the tower, on the opposite side of the slot. Thus a voltage is created along the slot similar to the voltage along the slot of the so-called slot antenna. Hence, an in-phase current sheet is created along the radiating element. The sheet radiator is so shaped to obtain even radiation.

The normal power gain of one element is 1.25. The tolerance on the input impedance is such that the voltage standing-wave ratio is 1.5 or less when fed by a 51.5-ohm transmission line between the frequencies of 88-108 megacycles. The horizontal pattern is essentially circular deviating from round by less than ½ db.

[5]Radio Corporation of America.

WABD TV-Antenna

(*Continued from page* 15)

ation. At B and C on the tower men were stationed to watch for any trouble. Seven hundred and eighty pounds was suspended on that line, with a 600′ drop to 53rd Street and the Eighth Avenue subway. Even the most experienced man was under tension as the pole was slowly raised to the position shown in Figure 9. This view illustrates how the pole was lifted above the required height and guided inside of the scaffolding where it was lowered over the first section of pipe which had been raised previously.

All sections of the pole were raised in the same manner and, as shown in Figure 10, the top section of pole—which was 3′ above the top of the scaffolding when in final position—was also manipulated into place from the same location.

All sections of the pole were placed in position and lined up, as indicated, by matching arrows provided for this purpose. Then the *batwings* were assembled on the pole, care being taken to align the four radiators of each bay in their respective vertical planes.

The sections were joined by means of a special peaning chisel. This chisel was supplied with the antenna and was

(*Continued on page* 38)

(*Continued from page 37*)

used to turn in or pean over the beveled edge of the outside section at the junction. The contractor was warned against using any lead caulking compound, and agreed that this was advisable.

The electrical work consisted mainly of installing:

(*1*) Deicing equipment.

(*2*) Feed-line system from radiating elements to the junction box.

(*3*) Two 1⅝" coaxial lines from the junction box to the diplexer in the transmitter room.

Here again the prevailing weather conditions made continuous work on any one of the three parts impossible. Therefore, the importance of detailed plans was again emphasized. The required coaxial sections which would be needed later were cut, and other work was done on the roof when it was too cold or too windy to climb the tower.

Extreme care was exercised in handling the ¾" feed lines, which are of soft-drawn copper and, of necessity, must be bent to specified forms. Each of the six lines were bent to the required shape on the roof. As shown in Figure 11, the end which folded back was taped to the other side of the loop wherever possible. Thus one side reinforced the other. In addition to this precaution against bending, the formed line was taped to a length of hard-drawn copper tubing. This resulted in a fairly rigid form which could be raised to the top of the structure and assembled.

In laying out the 1⅝" coaxial lines, the factors considered were:

(*1*) The characteristics of the rather new flanged-type transmission line; namely, that all lengths should be cut at multiples of a foot and the physical characteristics determine specific dimensions and limited directivity at elbows.

(*2*) The electrical specifications of the antenna array: Both lines should be symmetrical and of equal length from the junction box to a point just before entering the diplexer. At this point one line must be made ¼ wavelength longer than the other.

(*3*) It was desirable to have the vertical run as plumb as possible, thereby avoiding any chance of excess bending.

(*4*) The construction of the tower was such that there were only a few places where obstructions to a plumb line would not be met.

To accomplish the desired results, detailed drawings were prepared for each level of the tower. An additional drawing was prepared on transparent paper to show how the position of the vertical lines to the roof varied for each of the several possible methods of starting. By superimposing this drawing on the detailed drawings of each level of the tower, it was possible to determine not only which method would permit an unobstructed vertical line, but also the difference in the length of the horizontal lines from the termination of the vertical lines just above the roof to a hole in the roof where the lines were continued vertically to the diplexer. This difference in length indicated the possibilities of having one of the horizontal lines ¼ wavelength longer than the other.

Satisfactory results were obtained by selecting a combination of two 90° elbows; Figure 12. This permitted an unobstructed vertical run; held to a minimum the use of special inner conductors, which are required when odd lengths of transmission lines are used; and required a limited number of unbrazed flanges.

An account of the performance specifications, the method of testing for compliance with the specifications, and the result of such tests will be presented in the July issue of COMMUNICATIONS.

The Industry Offers

(*Continued from page* 30)

crease dissipation capability. Heater is 12.6-volt type.

The 12AU7 is a miniature twin-triode amplifier having characteristics which are very similar to those of the larger types 6SN7GT and 12SN7GT.

It utilizes a button base with 9 pins on a circle a little larger than that of the regular miniature 7-pin button base in order to provide the required additional base-pin terminals, and a glass bulb (T-6½) only slightly larger than that (T-5½) used on the regular miniatures.

Has a mid-tapped heater to permit operation from either a 6.3- or a 12.6-volt supply.

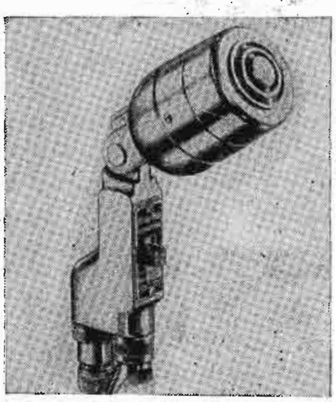
The 35B5 is a miniature beam-power amplifier for use in a-c/d-c receivers. Output 1.5 watts.

* * *

ELECTRO-VOICE ACOUSTALLOY DIAPHRAGM DYNAMIC MICROPHONE

A dynamic microphone, model 630, using an acoustalloy diaphragm, has been announced by Electro-Voice, Inc., Buchanan, Michigan. Frequency response is said to be substantially flat, 40-9000 cps; output level is 53 db below 1 volt/dyne/cm², open circuit; voltage developed by normal speech (10 dynes/cm²) is .0224 volt.

Built-in cable connector permits vertical tilting of microphone head in a 90° arc, for directional or non-directional pickup.



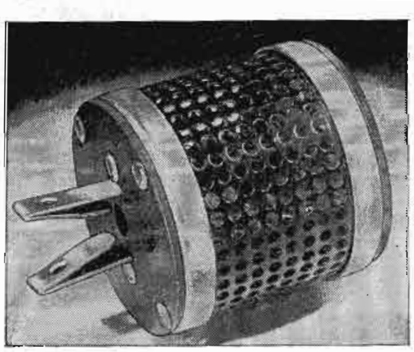
* * *

CLAROSTAT FLUORESCENT LAMP D-C CONVERSION RESISTOR

Two types of d-c conversion resistors are now being offered by Clarostat Mfg. Co., Inc., 130 Clinton St., Brooklyn 2, N .Y.

An accessory type, series AA, plugs between usual socket or outlet, and the usual attachment plug. Unit measures 1¾" dia. x 1¾" long. Three different ratings are available; 15-watt 120 v, 15-watt and 20-watt 110-v lamps.

Built-in type, series GT, is a flat perforated-case unit with mounting flanges, measuring 7" long x 1 13/16" wide x 1¼" high. Available for 15, 20, 30 and 40-watt lamps on 110 and 220-v supply.



* * *

OHMITE INDICATOR POTENTIOMETER

A direction-indicator potentiometer, RB-2, has been announced by the Ohmite Manufacturing Company, 4855 Flournoy Street, Chicago 44, Illinois.

For use as a rotary-beam antenna direction-indicator, the shaft of the potentiometer is

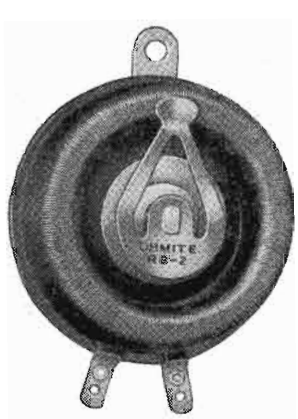
(*Continued on page* 40)

The Industry Offers

(*Continued from page 39*)

coupled to the rotary-beam antenna in such a way that the shaft of the potentiometer rotates with the antenna. The potentiometer is then connected, by means of a simple circuit, to a six-volt battery and an ordinary 0-1, 0.1.5, or 0-2-ma d-c meter. The ma will indicate the position of the antenna.

For complete information and circuit diagram, write for bulletin 128.



* * *

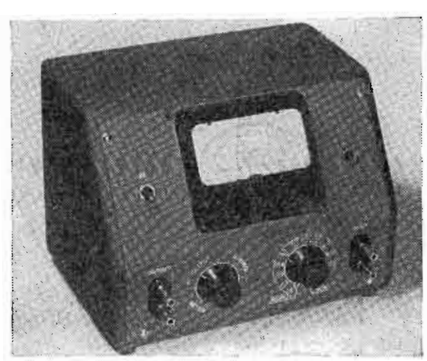
INSTRUMENT ELECTRONIC VOLTMETER

A voltmeter, 47, with a voltage range of 50 microvolts to 500 volts that is said to be accurate within $\pm 2\%$ from 15 cycles to 30 kc and $\pm 5\%$ from 30 to 100 kc, has been announced by Instrument Electronics, 42-17 Douglaston Pkwy., Douglaston, N. Y.

Input impedance is 1 megohm plus 15 mmfd shunt capacity.

Voltage ranges are indicated on a logarithmic meter with 20 db linear spread. Switch positions are provided every 10 db.

The instrument serves as a voltmeter and amplifier; amplifier gain is said to be 40,000.



* * *

SANGAMO PLASTIC MOLDED TUBULARS

Paper-tubular capacitors molded in plastic, have been announced by tbe Sangamo Electric Company, Springfield, Illinois.

These new capacitors are designated as type 30 and are offered in halo wax impregnated, in tan; and diaclor impregnated, in red.

* * *

TITEFLEX WATER-COOLED H-F CONDUCTOR

An h-f water-cooled flexible conductor current has been announced by Titeflex, Inc., 665 Frelinghuysen Ave., Newark 5, N. J.

Conductor consists of a brass, water-tight convoluted innercore with an outer braid conductor.

* * *

RCP PORTABLE TUBE AND SET TESTER

A portable tube and set tester, 805B, providing testing of standard, miniature and sub-miniature tubes, has been announced by Radio City Products Company, Inc., 127 W. 26th Street, N. Y. 1, N. Y.

Instrument combines a volt-ohm-milliammeter, tube tetster, battery and condenser leakage tester. Has a built-in "Rolindex" roll-chart. Uses germanium-crystal diode rectifier.

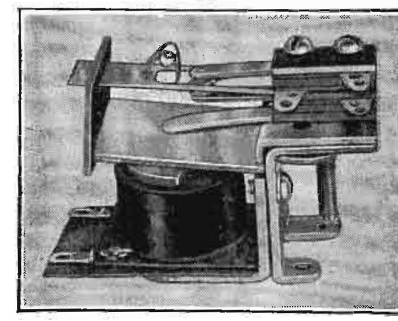
* * *

GUARDIAN SNAP-ACTION SWITCHES

A line of snap-action switches has been announced by Guardian Electric Mfg. Co., Inc., Dept. SA, 1617 West Walnut Street, Chicago, Ill.

Snap aetion feature is particularly suited to control applications that involve slow-moving, mechanical devices or where a given stroke is required to provide quick, positive make or break contact action.

The tension of the hair spring retains the contact assembly in either the open or closed position until the armature has completed its travel.

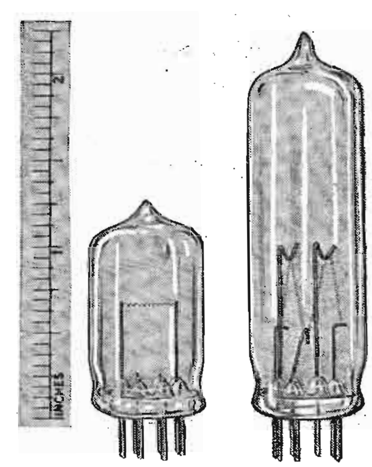


* * *

AMPERITE REGULATOR TUBE

A Regulator tube (miniature T5½ bulb) for regulating currents from 60 ma to 1a, has been announced by the Amperite Company, 561 Broadway, New York 12, N. Y.

With a 10% change in current, the voltage drop across is said to increase 200%; a change of current of 0.3 to 0.33a causes a change in voltage of 2 to 6v. Miniature octal base; base wiring, prongs 2 and 7.



* * *

RAPIDESIGN SYMBOL SHEET

A die-cut laminated-plastic radio symbol sheet for drafting bas been announced by Rapidesign, Inc., P. O. Box 592, Glendale, California. Laminated to .080 thickness. Inner contours are beveled.

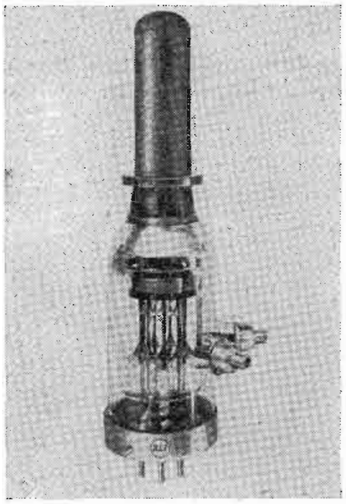
* * *

FTR THORIATED-TUNGSTEN FILAMENT A-M TUBES

Thoriated tungsten filaments are now being used in 50-kw a-m broadcast tubes by Federal Telephone and Radio Corporation Clifton, N. J.

The tubes are designated as 9C28 and 9C30 in the water-cooled types, and 9C29 and 9C31 in the air-cooled types. When used in modulating a 50-kw transmitter, the 9C28 and 9C29 are said to be capable of an audio output of 40 kw with virtually no grid driving power. Operating at a filament voltage of 15 and filament current of 135 amperes, the 9C28 has maximum ratings of 12,000 volts, plate voltage; 10 amperes, plate current; and 100kw, plate input.

The 9C30, designed for r-f amplifier application at frequencies up to 20 mc, operates at the same filament voltage and current and has maximum ratings of 15,000 volts, plate voltage; 8 amperes, plate current; 120 kw, plate input; and 40 kg plate dissipation.



* * *

ATR REPLACEMENT VIBRATORS

A line of auto radio replacement vibrators, featuring 3/16"-diameter tungsten contacts, mica-ceramic and metal stack spacers with two-bolt stack construction, has been announced by the American Television and Radio Co., 300 East Fourth Street, St. Paul 1, Minnesota.

* * *

SUPERIOR ELECTRIC AUTOMATIC VOLTAGE REGULATORS

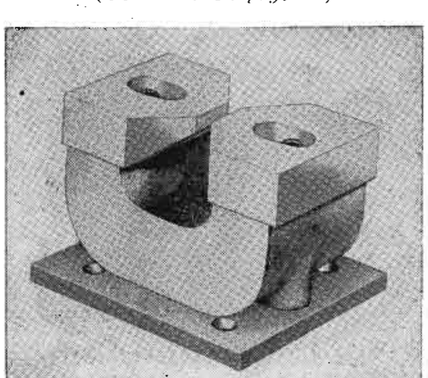
Voltage regulators (Stabiline) that are said to feature rapid detection of line voltage variations and non-microphonic performance have been announced by the Superior Electric Company, 104 Church St., Bristol, Conn. All removable components such as the voltage sensitive element and unbreakable, fast-acting relays are plug-in type.

* * *

THOMAS & SKINNER P-M CHARGERS

A series of permanent magnet chargers has been placed on the market by Thomas &

(*Continued on page* 42)



The Industry Offers

(*Continued from page* 41)

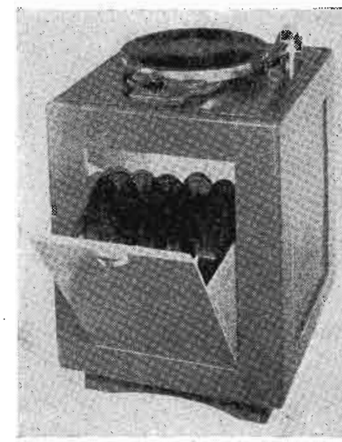
Skinner Steel Products Company, 1040 E. 23d Street, Indianapolis, Indiana.

Chargers, fabricated from Alnico V, are produced in two sizes, offering a usable magnetizing force up to 3,400 oersteds, and variable air gaps from zero to 1¼".

* * *

REK-O-KUT SOUND-SYSTEM CONSOLE

A console for use as a transcription or recording cabinet, has been announced by the Rek-O-Kut Company, 146 Grand Street, New York City. Will take either Rek-O-Kut recording or transcription turntables. The cabinet (32" x 24" x 26") has a drop front door, which has self-contained pockets for holding approximately 100 sixteen-inch records.

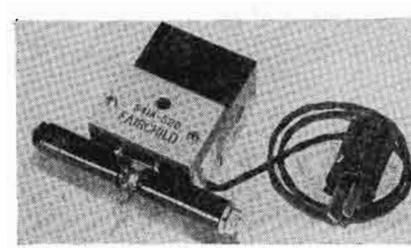


* * *

FAIRCHILD MAGNETIC CUTTERHEAD

A magnetic cutterhead, 541A, that is said to have a frequency response of ±2 db over a 30- to 8,000-cycle range, at a high recording level, with low distortion content (less than 1% at 400 cycles), has been announced by the Fairchild Camera and Instrument Corporation.

Features include a damping device, with long cushion blocks and a positive means of adjusting and maintaining the armature in correct alignment without disassembling the cutterhead; and a viewing window which permits instant check of the armature alignment.

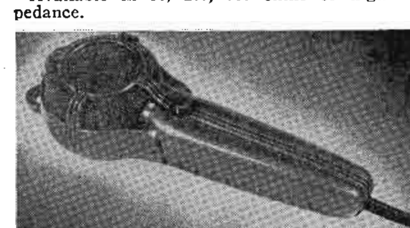


* * *

TURNER NOISE-CANCELLING MICROPHONE

A hand microphone, 15D NC, which cancels out background noise, has been announced by The Turner Company, Cedar Rapids, Iowa.

Available in 50, 200, 500 ohms or high impedance.



* * *

CAMBRIDGE THERMIONIC R-F CHOKES

Two r-f chokes have been announced by the Cambridge Thermionic Corporation, Department 10, 445 Concord Ave., Cambridge 38, Mass.

One type, LHC, high-Q iron-core, is available in 8 standard values: 2.5, 3.5, 5.5, 10.00, 30.00, 60.00, 80.00 and 125.00 millihenries with a current rating of 125 ma.

Second type, LAB, is a pie-wound unit, with a maximum allowable current of 125 ma.

News Briefs

INDUSTRY ACTIVITIES

Koad, Omaha, Nebraska, will soon install a 50-kw G.E. f-m station in a building which will occupy a forty-acre plot northwest of Omaha, adjacent to the transmitter site of a-m station KOWH.

The 50-kw f-m station, KSBR, at San Bruno, California, was recently placed on the air on 97.7 mc. Station is owned by Radio Diablo. Inc. and is temporarily located at plant of Eitel McCullough, Inc.

Transmitter designed and built by Eitel McCullough uses REL Armstrong dual-channel modulator driving four Eimac 4X500A Tetrodes, followed by two Eimac 3X2500A3 grounded-grid, followed by another push-pull grounded-grid stage using push-pull Eimac multi-unit triodes. Antenna is turnstile giving effective power to two-hundred kw.

General Electronics, Inc. has moved into a new two-story building at Paterson, N. J.

D. E. Replogle is President of General Electronics, Inc.

Experimental commercial radar equipment, designed by Bell Telephone Labs, has been installed aboard the S.S. John T. Hutchinson, of the Great Lakes fleet.

S. P. Taylor, manager, distributor sales of the W. E. radio division, was host to many honored guests during the installation ceremonies, which included Hon. Kneeland B. Wilkes, president, Buffalo City Council; Albert J. Zimmer, Buffalo manager of the Lakes Carriers Association; and Captain Harold Jacobson, skipper of the S.S. Hutchinson belonging to the Pioneer Buckeye S.S Company.

Remco Electronic Inc., 33 West 60 Street, N. Y. City, have issued a license for their cathode-follower circuit patents to the Bell Systems and Western Electric Co.

West-coast production of private brand receivers was initiated recently at the Riverside plant of Colonial Radio Corporation, wholly-owned subsidiary of Sylvania Electric Products, Inc. Opening of the plant was attended by Don G. Mitchell, president of Sylvania Electric and Allen H. Gardner, president of Colonial.

Pyramid Electric Company has moved to a new plant at 155 Oxford Street, Paterson, New Jersey.

Direct two-way radio-printer service between United Nations headquarters at Lake Success, New York, and the Palais Des Nations in Geneva was inaugurated recently.

At the opening of the circuit Brigadier General Frank E. Stoner, chief communications engineer of UN; Benjamin A. Cohen, assistant secretary general in charge of public information, UN; and Sidney Sparks, vice-president and traffic manager, RCA Communications, Inc.

The 23rd annual RMA convention will be held June 10-12 at the Stevens Hotel, Chicago.

FCC chairman Charles R. Denny is expected to deliver an address at a luncheon on June 12.

Howard K. Morgan, chief development engineer of Bendix Aviation Corporation's radio division recently presented a talk on "Air Navigation and Traffic Control" before the AIEE, IRE and the Institute of Aeronautical Sciences at the University of Cincinnati. He emphasized that airport surveillance with radar is now a necessity.

The first manufacturing unit of General Electric's Electronics Park at Syracuse, N. Y., was recently placed in operation. Transmitters are being built in this unit. Building is 700 feet long and 300 feet wide.

Microwave relay circuits are now being tested by the Signal Corps for communications between the War Department offices in the Pentagon and Headquarters Army Ground Forces, at Fort Monroe, Virginia.

Equipment has facilities for eight telephone conversations simultaneously, or a maximum of ninety-six printing telegraph circuits, or a combination of telephone and telegraph circuits.

(*Continued on page 44*)

News Briefs

(*Continued from page 43*)

Land-C-Air Sales, Inc., are now located at 14 Pearl Street, N. Y. 4, N. Y.

Clyde P. Elliott has been appointed Mountain States representative for C. P. Clare & Company, Chicago. Office is at 681 Grant Street, Denver 3, Colorado.

RKO Television Corp. executive offices are now located in the Pathe Building, 625 Madison Avenue, New York, between 58th and 59th Streets.

Ralph B. Austrian is president of RKO Television Corp.

* * *

The FTR Clifton, N. J., plant facilities have been expanded and approximately 850,000 square feet space are now being used for manufacturing and development.

PERSONALS

George P. Adair, former chief engineer of the FCC, has opened a consultant office at 1833 M Street, N.W., Washington, D. C.

Herbert M. Hucke is now sales manager of the newly consolidated RCA communications and specialty section. **Joseph M. Hertzberg** has been named manager of aviation radio sales to succeed Mr. Hucke.

* * *

George A. Scherry has been appointed chief electrical engineer of Grayhill, La Grange, Illinois.

Paul J. Pfohl has become western manager of the commercial department of RCA Laboratories Division.

John M. Otter has been named general sales manager of Philco Corporation. Otter has been a member of Philco since 1926 and for the past three years he has been sales manager of the radio division.

John K. Hilliard, chief engineer of the Altec-Lansing Corporation, recently delivered a paper on and gave a demonstration of the intermodulation distortion analyzer before a group of Chicago broadcast, manufacturing and university engineers and research men. The meeting was sponsored by Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill.

Marvin G. Whitney, Clarrell R. Rigby, Donald K. Sieburg, and **Thomas G. Reed** have been named plant managers of the RCA broadcast and industrial electronics manufacturing, communications and aviation radio manufacturing 16 mm motion picture equipment, theatre equipment, and test and measuring equipment; and parts fabrication divisions, respectively.

George T. Emerson is now with KRUX Radio, Arizona, and affiliated enterprises headquartered in Phoenix.

Virgil E. Trouant, Robert R. Welsh, and **William J. Morlock** have been appointed section managers of the broadcast and industrial section, which includes broadcast, television, and industrial electronics engineering; communication and specialty section, which includes communication, aviation, and mobile radio engineering; and distributed products section, including sound products, motion picture sound, and test equipment engineering, respectively.

H. W. Clough, vice president of the Belden Manufacturing Company, Chicago, recently celebrated his 25th year with Belden.

L. John Denney is now vice president of the Federal Telephone and Radio Corporation.

R. W. Gothard, Gothard Manufacturing Company, Springfield, Ill., has purchased the tools, equipment and inventory for dynamotor, inverter and motor generator production from Pioneer Gen-E-Motor, Chicago, who are discontinuing the manufacture of these items. **Harold Argue** has left Pioneer to become chief engineer of Gothard.

Robert Welker, former production manager for Pacific Electronics, Los Gatos, Cal., has become production manager of General Electronics, Inc., of Paterson, N. J.

Earle C. Thompson, recently advertising manager of International Resistance Company, Philadelphia, has joined the staff of John Falkner Arndt & Company, Inc., Philadelphia advertising agency.

John G. Wilson, formerly operating vice president of the RCA Victor Division, has been appointed vice president and general manager. **Fred D. Wilson** has been named vice president in charge of operations.

Lt. Commander William J. Rooke (U.S.N.R.) has become director of the service department of the Hammarlund Mfg. Co.

* * *

Perry Saftler, 53 Park Place, New York City, has been appointed Astatic representative in the New York Metropolitan area.

Rocke International Corporation, 13 E. 40th St., New York City, has been named export representatives for National Union Radio Corporation, Newark, N. J.

C. R. Runyon, Jr., has become president of Radio Engineering Labs. Frank A. Gunther continues as vice president and treasurer.

Morton E. Riegel, assistant director engineer of Triplett, has been appointed officer in charge of electronics in a district naval reserve training unit in Lima, Ohio. He is a lieutenant commander in the U.S.N.R.

Major General Spencer B. Akin has been named Chief Signal Officer of the Army. General Akin succeeds Major General Harry C. Ingles, who has retired.

Henry I. Metz is now superintendent of the communications branch in Region II of the CAA.

LITERATURE

Westinghouse Electric Corporation, 306 Fourth Ave., Pittsburgh 30, Pa., has released a 25"x36" electron-tube wall chart.

Appearing on the chart are data on basic structures, action of gas-filled and vacuum tubes, and six primary functions of electron tubes—rectification, amplification, generation, control, changing light into electricity, and changing electricity into radiant energy.

Price of chart is $2.00.

P. R. Mallory & Co., Inc., Indianapolis, Ind., has released a specification sheet on contact spring assemblies, with detailed dimensional drawings of three groups of standard contact springs.

Printed on tracing paper suitable for blue printing.

John F. Rider will soon publish a 2,000-page issue of his service manual, volume XV, which will feature clarified schematics from every band of every multi-band set put out by manufacturers during 1946.

Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago 12, Ill., has published a relay catalog, 10A, illustrating basic type (standard) a-c and d-c relays, locking relays, stepping relays, contact switches and switch parts.

The G. E. tube division has prepared a 700-page manual on receiving tubes. Manual covers applications, performance curves, ratings, outline drawings, basing diagrams, etc.

Price, $5.00; available from the electronics department, tube division, Building 267, General Electric Co., Schenectady 5, N. Y.

Sorensen & Co., Inc., 375 Fairfield Avenue, Stamford, Connecticut, has issued a 16-page catalog, describing the principles of operation and technical specs of electronically-controlled voltage regulators and Nobatrons.

The Hammarlund Mfg. Co., Inc., 460 W. 34th St., N. Y. 1, N. Y., has released a 6-page leaflet describing a secondary frequency standard which uses a 100-kc crystal.

W. P. Miller, 536 F Street, San Diego 1, Calif., has published a book on slide rule shortcuts, which is available for $1.00.

North American Philips Company, Inc., 100 East 42nd Street, New York, has prepared a 4-page folder describing construction of a trimmer which consists of a stator having three concentric cylinders that slide in the spaces between the four concentric rings of the rotor.

Trimmer has a minimum capacitance of 2.5 mmfd and a maximum capacitance of over 30 mmfd.

Thomas & Skinner Steel Products Company, 1040 East 23rd Street, Indianapolis, Indiana, have published a 16-page bulletin on the "Use, Design and Fabrication of Permanent Magnets."

Bulletin contains a discussion of the advantages and limitations of permanent magnets in many present and potential applications, plus technical information and data on all known magnet materials and basic design formulae.

E. F. Johnson Company, Waseca, Minn., have announced a condensed general parts catalog, No. 969, covering variable transmitting capacitors, inductors, tube sockets, Q antennas, insulators, plugs and jacks, couplings, r-f chokes, multi-wire connectors, pilot dial and panel lights, and tube can connectors.

Battery Branch, Squier Signal Laboratory, Fort Monmouth, New Jersey, has prepared Signal Corps Specification No. 70-400, covering portable lead-acid storage batteries, to be used in procurement by the Signal Corps of storage batteries required by the Armed Forces.

According to the Signal Corps these specifications are unusually well prepared and could be used as an industry standard of design.

Copies of this specification may be obtained from the Office of Technical Services, U. S. Department of Commerce, Washington, D. C., for a small charge.

Radio Condenser Company, Camden, N. J., has prepared a 4-page bulletin describing the Rotonoid. Bulletin supplies details of construction, possible variables and a list of suggested applications. A chart showing the torque curves at various voltages is also included.

Allied Radio Corporation, 833 West Jackson Boulevard, Chicago 7, Illinois, have published a 164-page catalog, covering tubes, test instruments, transformers, resistors, condensers, rheostats, relays, switches, rectifiers, tools, wire and cable, batteries, sockets, generators, power supplies, etc.

Cannon Electric Development Co., 3209 Humboldt Street, Los Angeles 13, California, have published a 76-page illustrated book on "Cannon Plugs for the Electric Circuits of Industry." Book is a digest of ideas for assembly, servicing, maintenance and portability of electric equipment through the use of connectors.

3-Kw F-M

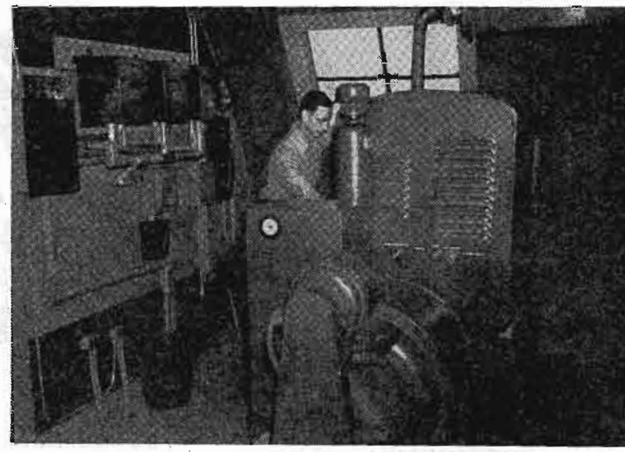
(*Continued from page* 18)

tower once supported one end of our original a-m inverted *L* antenna erected atop the Onondaga Hotel in 1924. Our permanent f-m antenna is mounted into the top of the supporting structure, giving an overall height of 147′. In addition, a 160-mc relay-broadcast antenna was mounted at the very top of the f-m broadcast antenna, with its ⅞″ 51.5-ohm transmission line inside the circular-antenna pole and going to a platform about 15′ below the top of the 105′ supporting tower. Mounted on this platform, in a weatherproof housing, is a 160-mc f-m receiver[7] and a transmitter[8] for relay broadcast purposes. The relay equipment can be controlled from the control desk in the transmitter equipment room and from the studio 11 miles away by simplexing on the studio transmitter orderwire circuit.

The crane used in raising the antennas to the top of the tower was the tallest crane ever used in Onondaga County. The erection contractors[9] (also the original tower fabricators), found it necessary to add a 25′ section to the crane boom. Even then there was only 16″ to spare when the antennas were raised to the mounting height.

Studio-Transmitter Program Circuit

After considerable effort, the New York Telephone Company succeeded in installing, between the f-m studio and the transmitter, the first 50-15,000 cycle program line in the Syracuse area. There was trouble with cross-talk and dial clicks which brought the average noise level above the –60 db required by the FCC. This noise level has been corrected so that we are now operating with an average noise of approximately 60 db below program level. It must be remembered that, in order to make a line flat between 50 and 15,000 cycles over a distance of 14 miles of telephone line, there is a large amount of attenuation due to equalizing. This necessitated the use of a repeating amplifier about 5 miles from the studio.



D. F. Langham at 25-kw 3 phase 230-v a-c gasoline generator and power distribution panel.

Temporary Studio

The f-m studio is quite temporary and consists of one small control room with two turntables[10] and an announce microphone, plus a small combination office and announce studio. The control room installation was made according to good engineering practise with all a-c circuits, and all audio wiring with both high and low level audio separated in different conduits. Even with these precautions, there was a higher than tolerable a-c hum leaking from conduit to conduit. It was found that switching lights off and on would raise and lower the hum level. By adding a greater a-c load, the lights would affect the hum in reverse. Certain conduits, and not just the wiring in those conduits, had to be removed, and complete conduit bonding was added in order to reduce the hum level to the minimum requirements.

Turntable rumble gave some difficulty, but the trouble was eliminated by placing live rubber washers between the pickup arm[11] and the arm mount.

Our original installation would have been satisfactory for standard a-m broadcasting which requires extraneous noises to be only 50 db below 100% modulation between 150 and 5,000 cycles, and only 40 db below 100% modulation from 50 to 150 cycles and 5,000 to 7,500 cycles. Due to the severe requirements of f-m where the noise must be 60 db below the program level required for ±75 KC swing from 50 to 15,000 cycles, ordinary precautions might not be sufficient. There probably will be other troublesome situations which will arise, similar to those found in our temporary studios, when we construct our permanent studios as soon as building materials become available.

[6] Link 3XA.
[7] Link 1905.
[8] Link 1906.
[9] Syracuse Engineering Company.
[10] Presto.
[11] RCA.

WHEN YOU CHANGE YOUR ADDRESS

Be sure to notify the Subscription Department of COMMUNICATIONS, 52 Vanderbilt Avenue, New York 17, N. Y., giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

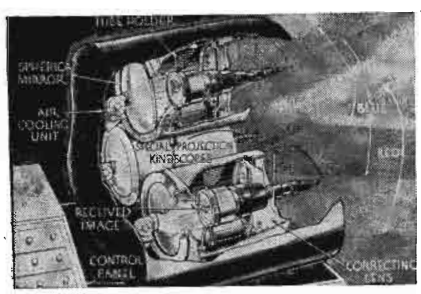
LARGE SCREEN COLOR TV

COLOR TELEVISION PICTURES on a 7½'x10' theater screen were demonstrated recently during a meeting at The Franklin Institute, Philadelphia, Pa.

The system used the all-electronic simultaneous method developed at RCA Laboratories, Princeton, N. J.

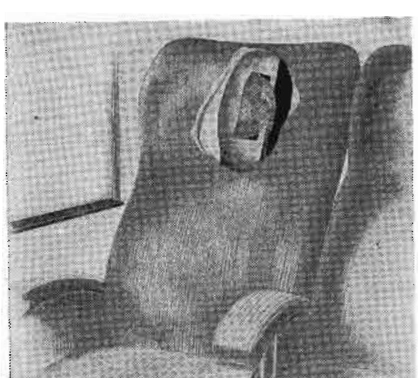
The pick-up unit used in the demonstration incorporated the *flying spot*; light is created on the screen of the kinescope by an electron scanning beam. The light from this spot is projected through color slides or films, scanning the entire surface of the scene or object, point by point. As the light beam, then tinted with color, emerges from the film or slide, it passes through a series of filters which separate respectively the red, green and blue portions of the color in the beam.

Among those who contributed to the development of the system were: R. D. Kell, television section head, and his associates (principles of the system); Dr. D. W. Epstein, cathode-ray and optics section head, and his associates (designing and building the receiver-projector and contributing to the optical design of the unit); Dr. F. H. Nicoll, research engineer (developing the necessary special projection kinescopes); and A. C. Schroeder, K. R. Wendt and G. C. Sziklai, of the television section (contributing to the development of the flying-spot color pick-up unit).



Above, interior view of color-projection unit. Below, color-projection unit in operation.

RAILROAD RADIO SEAT

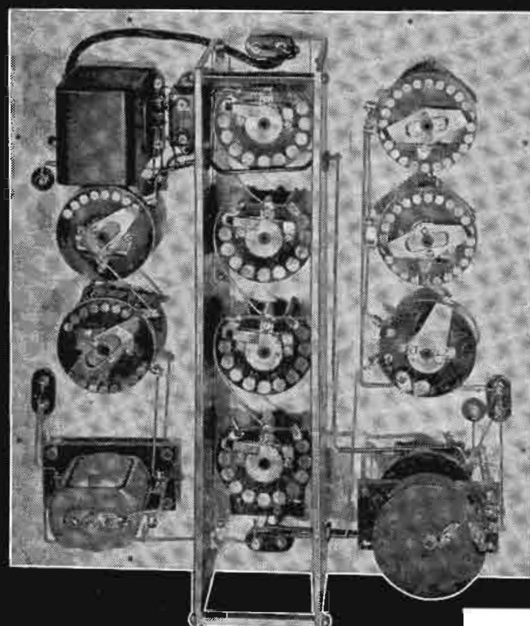


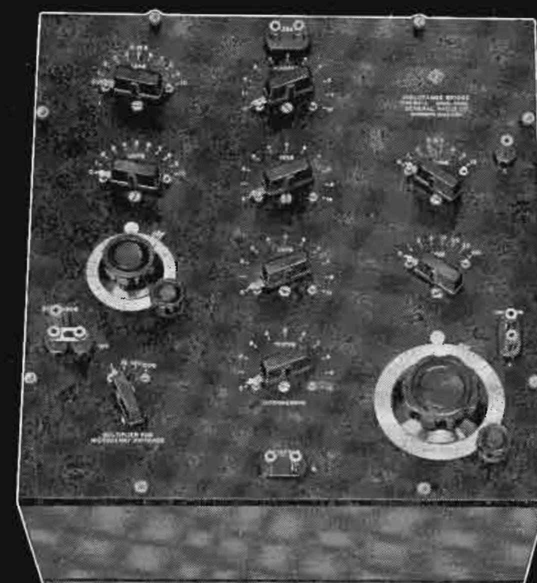
Cutaway of a radio seat developed by the Budd Company for use in coaches. Speaker is embedded in rubber in a head rest and operates at ear level. Controls at base of arm rest provide program selection.

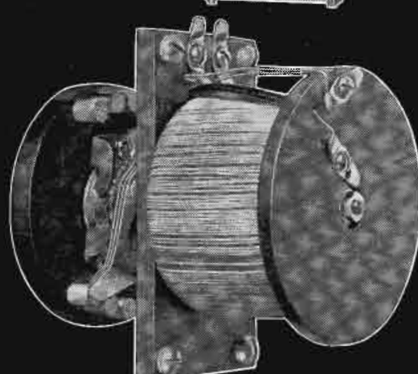
ADVERTISERS IN THIS ISSUE

COMMUNICATIONS—MAY, 1947

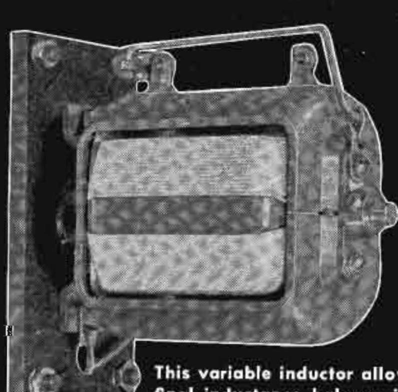
FOR PRECISE MEASUREMENT OF INDUCTANCE







The 1-millihenry toroidially wound standard



This variable inductor allows a final inductance balance independent of the resistive balance

FROM 0.1 MICROHENRY TO 1 HENRY

The Type 667-A Inductance Bridge is widely used in the laboratory and in production for precision measurements of the inductance of coils. It employs a standard bridge circuit with a number of unique design features which make it direct-reading, with high accuracy and convenience.

FEATURES

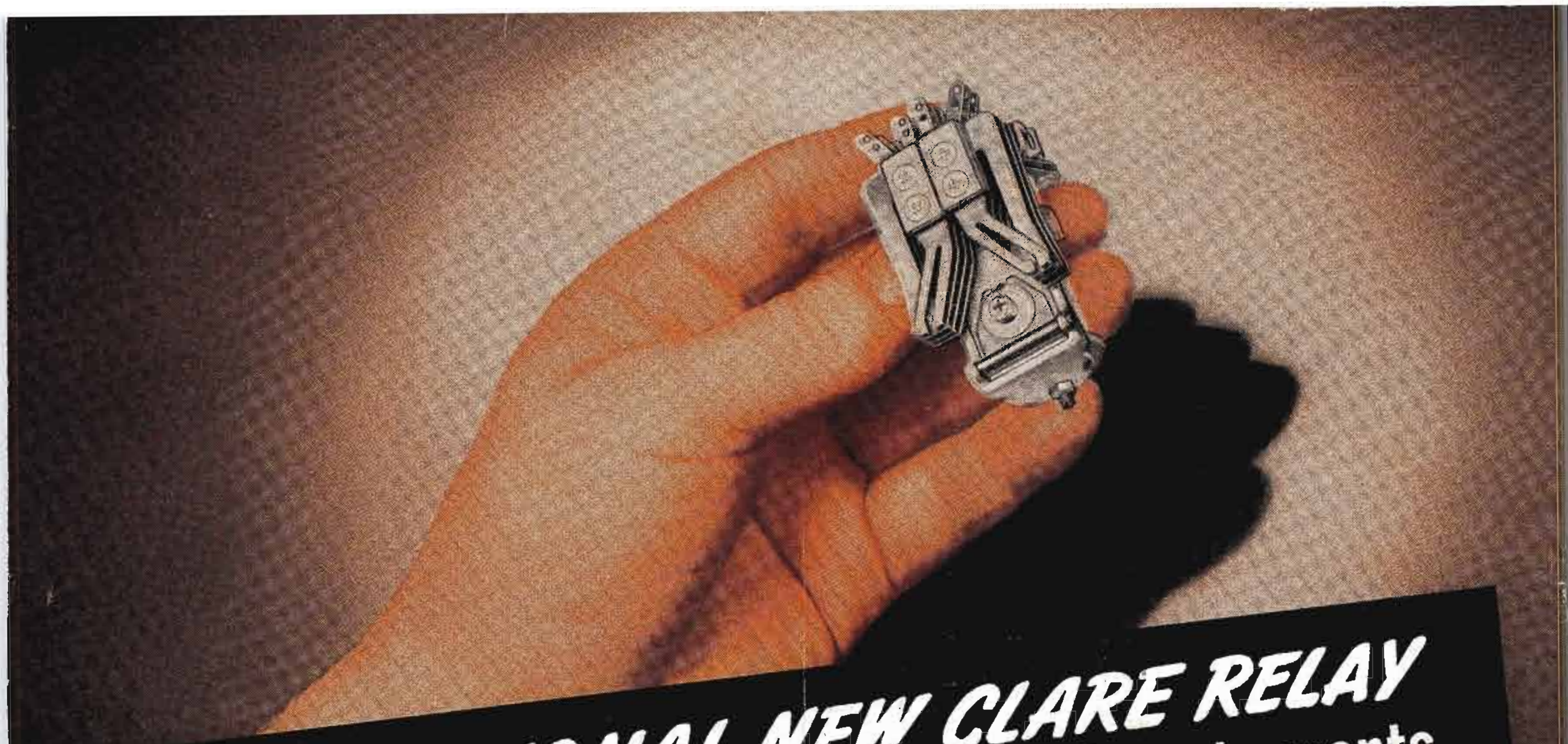
- **DIRECT READING** from 0.1 microhenry to 1 henry.
- **HIGH ACCURACY** — ±0.2% or ±0.1 μh over major portion of its range.
- **RANGE** can be extended considerably with external standards.
- **CALIBRATED** for 1 kc use — can be used at frequencies between 60 cycles and 10 kilocycles with less accuracy.
- **VARIABLE RESISTORS** in standard and unknown arms inductance compensated to give constant inductance.
- **ERRORS** from sliding-zero balance have been eliminated.
- **INDUCTANCE BALANCE** independent of resistive balance.
- **STANDARD INDUCTOR** toroidially wound to minimize magnetic pick-up.
- **WITH AUXILIARY VARIABLE CONDENSER** can be converted into a resonance bridge — one of the most precise measuring techniques for determining resistance of inductors at audio frequencies.
- All four corners of the bridge available on panel. Bridge elements can be used to form a number of other circuits.

PRICE: Type 667-A Inductance Bridge $400.00
(Accessories needed are oscillator, amplifier and head telephones)

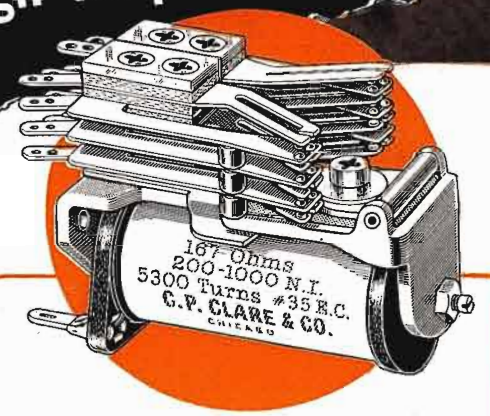
NOTE — A few in stock for immediate shipment — ORDER NOW!

GENERAL RADIO COMPANY Cambridge 39, Massachusetts

90 West St., New York 6 — 920 S. Michigan Ave., Chicago 5 — 950 N. Highland Ave., Los Angeles 38



A SENSATIONAL NEW CLARE RELAY
Streamlined to Meet Modern Design Requirements



New CLARE Type "J" d.c. Relay Combines the Best Features of Conventional Telephone Type Relay With Tiny, Lightweight Aircraft Design Relay

• This new CLARE Type "J" Relay gives you unheard-of performance in the small size and light weight that meet modern streamlined design demands.

Sturdy construction, large contact spring capacity and adaptability to a wide range of specifications, are provided in a relay which weighs slightly more than two ounces, slightly more than two inches in length.

Here at last is a twin contact relay in which the chance of contact failure is reduced to the lowest possible limit. The long, flexible contact fingers of the bifurcated stationary springs allow the contacts to operate independently of each other. One contact is sure to close even when the other may be blocked by presence of dust or grit.

Twin contact points have high rated current carrying capacity of 4 amperes, 150 watts, permit use of standard twin-contact springs for most applications.

These are but a few of the remarkable features which make this new CLARE Type "J" Relay a valuable addition to the Clare line of "Custom-Built" Relays and Stepping Switches which most effectively meet tough relay design requirements. Clare Sales Engineers are located in principal cities to discuss relay problems with you. Look in your classified telephone directory or write: C. P. Clare & Co., 4719 West Sunnyside Avenue, Chicago 30, Illinois. Cable Address: CLARELAY. *In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.*

CLARE RELAYS

"Custom-Built" Multiple Contact Relays for Electrical and Industrial Use

Outstanding Features of CLARE Type "J" d.c. Relay

Independent Twin Contacts: Dome shaped contacts on movable springs; flat discs on fixed springs.

High Current-Carrying Capacity: Twin contact points of palladium contact material have rated current-carrying capacity of 4 amperes, 150 watts.

Concealed Wiring: All contact-spring terminals as well as coil terminals located at rear end of relay. Wiring concealed when relay is mounted on panel, base or mounting strip.

Large Armature Bearing Area: Hinge-type armature has bearing of completely new design which provides largest possible bearing surface. Pivot pin turns in cylinder of a different metal, which is full width of the heelpiece.

Efficient Magnetic Structure: Heelpiece and other magnetic iron parts are exceptionally heavy for the size of the relay, providing a highly sensitive and efficient magnetic path.

High Operating Speed: Designed for extremely fast operation . . . a minimum of one to two milliseconds.

Large Contact Spring Pileups: Both single and double-arm relays are available. Power and sensitivity permit handling of large spring loads . . . maximum of ten springs on single arm relay . . . 20 springs (10 in each pileup) on double-arm relay.

Coils . . . Single or Double Wound: Either single or double coil windings can be provided.

Dimensions: Overall length: 2¼"; Width: 1¾" (with 10 springs); Height: 1⅛".

Weight: Net: 2½ oz. (approx.).